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Moulding Pulleys.

BY ROBERT E. MASTERS.

The drawings will show two methods of strengthening light rims in pulleys with a broad face, without materially increasing their weight.

An order was given for a pulley 24″ diameter, 18″ face. A pulley-ring pattern, 6″ face, was selected, which was rather light for width of face required. After the pattern had been drawn up part way, suitable arms were bedded in and the pulley drawn up to the proper height; the pattern was drawn out of the mould; the cheek *A A*, Fig. 1, lifted off; the upper half of the core set off, and the arms drawn out the same as in moulding any ordinary pulley from a band or ring pattern. A light bracket *B B* was then cut in the sand from the arms to the rim of the pulley. To have these brackets alike, so that the pulley would not be too much out of balance, a piece of wood was got out for a pattern the size of the bracket, and fitted into each place when the sand was cut away.

The line shaft in a factory extended 7′ beyond the last hanger; a pulley 18″ diameter, 14″ face, was wanted to go on this shaft outside of the hanger to drive a machine in a certain location. The machine had a tight- and loose pulley to be driven by a 6″ belt. In ramming up this pulley, Fig. 2, tapered curved strips *C C* were bedded in under each arm from the rim to the base of the hub, the arms being flush with the top of the rim. When the arms and lower half of the hub had been drawn from the mould, the curved strips *C C* were drawn out before the rim was drawn, and the pulley cheeked off to dress the mould.

It was claimed that "these curved strips would give more strength to the rim than straight strips running diagonally from the rim to the base of the hub." (It seems as if that theory was like advocating that a crooked or bent column would sustain more than a straight one.)

It might be thought by some, "Why not make the arms down in the rims far enough to let the rim come close to the hanger?" This would have made it necessary to change the position of the machine—a move desirable to avoid.

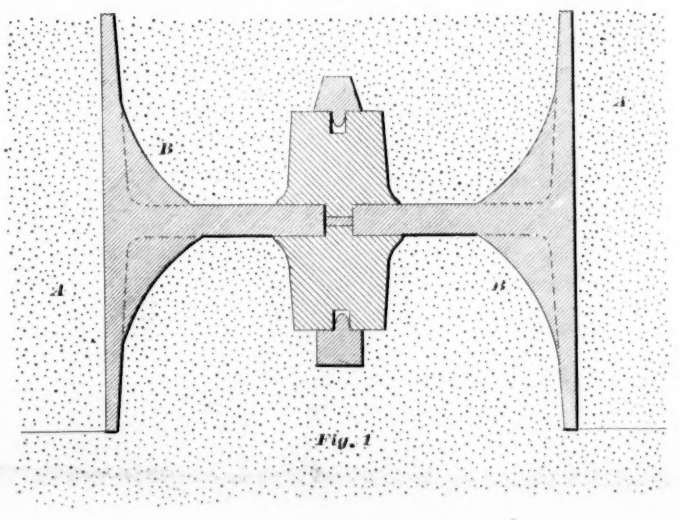


Fig. 1

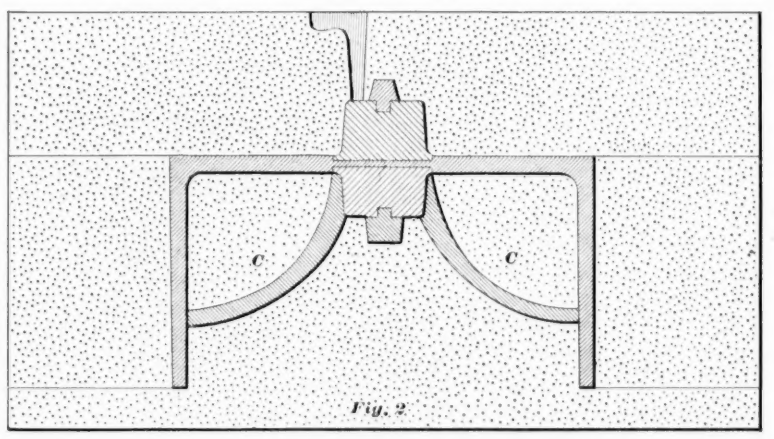


Fig. 2

MOULDING PULLEYS.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

TWENTY-THIRD PAPER.

The Egyptian papyrus appears to have been in high repute with the Romans until sometime during the fifth century of our era, when it was superseded by cotton paper, then called *carta bombycina*. The credit of this important discovery or invention has been attributed variously to Greece, Italy and Germany; other accounts give China the credit, and that from thence the paper itself was brought to Mecca, there carried by the Arabs to the coasts of Barbary, from whence it found its way to Spain, Italy and Greece.

When Nathan Dunn brought his great collection from China, and opened in Philadelphia what for years was known as the Chinese museum, he exhibited two specimens of paper documents dating back to about two centuries before the Christian era. Mr. Dunn was a man of sterling integrity, and fully believed what he represented. He said that he obtained the specimens in a manner that left no doubt in his mind as to their authenticity. The writing or characters on these specimens appeared to have been made with a brush, although some of them had that peculiar dead surface due to block printing. These specimens were so tender by age as not to bear handling without great care. They were kept between plates of glass. I examined them with care. They certainly were not the united strips of papyrus, but a regular long fiber paper, and, although greatly discolored, it was plainly to be seen that they were a well felted paper, similar in character to the present Chinese paper. It has been claimed that the Crusaders brought not only the paper but the art of manufacturing it to France. The first authentic accounts we have of the manner of preparing paper pulp from hempen, linen or cotton rags, was by fermentation or a species of putrefaction in closed vessels, and beating into pulp in mortars similar to the fuller's mill, or by iron-shod pestles or stamps in wooden mortars. It required 40 of these stamps, working day and night, to prepare the pulp from 100 lbs. of rags, unless the putrefaction had been carried to such an extent as to be injurious to the fibre and wasteful to stock; but it was always a strong temptation to the paper-maker, and probably accounts for as much of the variation in quality of the oldest paper as the original quality of the rags used.

The first real advance in the art of paper-making in the long period of eighteen hundred years is due to Holland in the invention of the cylinder-beating engine for comminuting rags into paper pulp, and dispensing with the injurious and wasteful rotting process. This invention dates about the middle of the last century, but it was not long in finding its way into France, and thence into England. The first English paper mill was erected by a German jeweler in the service of Queen Elizabeth, about the year 1588. But for two hundred years thereafter, or up to about 1788, England depended upon Germany, Holland and France for the finer qualities of writing, drawing and copper-plate papers. From England the art was brought to America by the early colonists, and was pursued in the same crude manner it had been done from its earliest invention. A millwright in the employ of my grandfather, who, when I was but a boy, was aged and almost superannuated, claimed that some years prior to the Revolution he had constructed the first cylinder-beating engine in America. He never tired of telling of the difficulties Mr. White experienced in what he called laying and welding the steel to the wrought-iron bars or blades for the beating rolls and bed plates. The Mr. White he referred to was most probably the father of the John White whose screw cutting process I described in my first and second papers, as he was the brag blacksmith of that time. Imported blister steel was all that could be obtained. This was drawn under a light trip-hammer into bars of the proper size, laid on and welded to the iron bars. If this millwright's statement was correct, and I know no reason to doubt it, it places the introduction of the beating engine into America simultaneous with its introduction into England, and shows the rapidity of the spread of the first real advance in the art of paper-making.

But, still, every sheet of paper, no matter of what quality or for what purpose, was made at the vat, on hand moulds, and it was not until the present century that the great advance in the art took place, the evolution or transition from hand-made paper to the continuously automatic machine-made paper. These wonderful changes, the perfecting the greatest labor-saving machinery of this or any other age, have been accomplished within the lifetime and memory of many persons now living.

The object of my giving the above sketch of what is known of the history of paper and its manufacture, is to place in a striking light the vast improvements which have resulted from mechanical ingenuity in so comparatively short a period after a start was made.

For the fourteen years preceding 1840, I had been more or less employed on machinery and appliances pertaining to paper-making. It was during this period that the most marked progress was made, and was strongly impressed on my memory; in fact, from my earliest recollection, everything pertaining to paper-making was familiar to me. I might almost claim to having been born to the business, my grandfather, Nathan Sellers, having been the first person to establish the business of wire-drawing and wire-working, and certainly the first man who made a pair of paper moulds on this continent. The exact date of his first work of the kind is not known. At my request, my brother Coleman, who has in his possession many old family papers, among them some of my grandfather's memorandums as far back as the year 1773, has searched them for entries as to wire work and paper moulds, and has sent me abstracts from such as he has found. The first entry is April 8, 1773: "Weaving wire and nailing hoops;" no doubt sieve hoops, and appears to be a mere incidental memorandum, but shows that at that date the business had progressed beyond the first stage of wire-drawing to weaving, involving the erection of a wire-weaving loom. The only other memorandum during that year, referring to wire, is Dec. 23: "Made surveying chain." During the year 1773, and until the trying times of 1776, my brother does not find any notes as to the wire business, which was during that time being regularly pursued, but he finds many references to clerical scrivener work, such as drawing deeds, etc.

Much of the Quaker seems to have been laid aside, as there are many notes of having gone to reviews or attending muster. But in all the many conversations I have had with my grandfather as to his early experience in drawing wire, weaving and making paper moulds, and other work for paper mills, I do not recollect his ever having referred to what we find entered from the 6th to 19th of January, 1776—that was "Making Saltpetre," "Boiling Saltpetre." But these entries show the direction of the minds of earnest men of those exciting times, and are followed by memorandums from February 3 to March 10, such as "Making priming wires and brushes"—a significant reminder of the days of flint-

locks—with the maxim of "Peck your flints and keep your powder dry." On the 10th there is an entry, "Got 400 sheets of money to sign." From this time his work seems to have alternated between signing Continental money, wire work and attending muster, until the 17th of May, when we find "Straightening wire for paper moulds." This is the first memorandum referring to paper moulds; but, like the entry as to weaving wire in 1773, it throws no light as to the date of his first work of the kind. The following entries make frequent reference to laying the face of paper moulds, drawing wire and attending muster:

The entry of August 13th is, "Wrote Colonel Paschall's will," and on the 15th marched with his regiment for New Jersey. Now come some curious documents showing the dependence of the paper-makers of only 110 years ago on a single man. The first is a certified extract from the minutes of Congress, dated August 26th, 1776:

"A petition from sundry paper-makers was presented to Congress, and read, praying that Nathan Sellers, an associator in Col. Paschall's battalion, and who has marched to New Jersey, may be ordered to return home, to make and prepare suitable moulds, washers and utensils for carrying on the paper manufactory.

"*Resolved*, That the prayer of the petition be granted.

"(Sig.) Chas. Thomson, Sec'y."

On the reverse side of the above is written: "The within Nathan Sellers, being discharged the service, agreeable to the within resolve of Congress, he, together with his father, John, and brother, Samuel Sellers, messengers on this occasion, having first produced the permission of the Hon'ble the Committee of the City and Liberties of Philadelphia to come forward to this camp, they are permitted, viz., John Sellers, the father, and Nathan and Samuel Sellers, his sons, to pass from hence to Philadelphia.

"Headquarters, August 30, 1776.

"(Sig.) Dan'l Roberdeau,
"Brigadier-General.

"Jonathan Paschall, Col."

The army was at that time encamped at Newark, N. J. They left for home the 30th, arriving there the evening of September 1st. On the 3d we find him at work on paper moulds, continuing in the old routine, diversified by signing Continental money on September 24 and 25; brassing (this means new facing) and water-marking moulds for Willcox, of Joy Mills, Chester County, Pa., now Delaware County, at that time making paper for Congress and for Continental money under military protection. I will here remark that up to the present time the Willcoxes continue extensively engaged in making the finest qualities of bank-note paper.

I have often listened with great interest to my grandfather's account of the straits the people were reduced to for want of paper during the revolutionary embargo. Fly-leaves were torn from printed works and blank leaves from account books for letter-writing. The stock of paper for printing Continental money had run out, the English-made paper moulds had worn out, and there was no wire in the country to reface them. This was the state of affairs when his honorable discharge from the army was granted by special Act of Congress. From the many conversations I had with him on the subject, I got the impression that the object was to employ him in making moulds for the Government use; that it had been represented that he was competent to do so, and not that he had been pursuing the business; and that on his return he had immediately gone to Yorktown, Pa., and there made the moulds for the Government, but his diaries, from which I have made the above quotations, throw a different light on it. The refacing the moulds for Willcox was undoubtedly for making paper on them for the Government. But soon after, say October 9th, an entry shows that he commenced making the frames for Continental moulds, and continued on that work the remainder of that month. It was not until a later period, and during the time the British had possession of Philadelphia and the Government offices were at Yorktown, Pa., that he was called there by the following letter:

"Yorktown, April 11, 1778.

"Sir: The Honorable the Treasury Board having occasion of another form for making of paper, you are, therefore, as a good Whig and sincere friend of American liberty, requested without any delay to accompany the express who takes this to you, so that you be here as soon as possible, bringing with you such tools as may be necessary. As to wire, we have enough here with us.

"(Signed) Yours, etc.,
"M. Hillegas.

"Please to keep an account of your expenses, as they will be reimbursed.

"To Mr. Nathan Sellers."

This job was, no doubt, duly completed, as is shown by a copy of a bill in £84 and the following safe passes:

"This may certify that Mr. Nathan Sellers, ye bearer hereof, is on his return from Yorktown to Darby township in Chester county, and ought not to be molested or impeded on his way, having been employed by ye Board of Treasury and given evident marks of his attachment to ye cause of ye United States.

"(Sig.) E. Gerry.

"Yorktown, May 2, 1778."

"War Office, Yorktown, May 3, 1778.

"Permit the bearer, Mr. Nathan Sellers, to pass unmolested from hence to his father, John Sellers, in Darby township, Philadelphia county, he being a loyal subject of these States.

"By order of the Board.
"(Sig.) Richard Peters.

"To all Continental officers and others whom it may concern."

The entry of May 17, 1776, of "Straightening wire for paper moulds" refers to what was known as laid moulds, in contradiction to woven or vellum-faced, each successive wire being laid by hand on the frames they were to cover and form the faces of; being secured at each bar, one to the other, by hand-twisting the cross-wires that were of such a thickness as to regulate the spaces between each parallel wire. It must be self-evident to any one that the hard brass wire from the reel or coil, and simply cut into lengths with its set or curvature, could never be laid one wire parallel with the other, preserving equal distances apart, without first having the curvatures taken out and being made perfectly straight. My grandfather had preserved all of his original tools, including the straightening board used at the time of the above entry; also a wire-drawing block, made of lignum-vitæ, wire plates, rippers, that is, link pincers that closed, gripping the wire in the act of drawing it—all of which were in my possession until my removal to the West in 1841.

Looking at these old relics it was always a marvel to me how a young man, fresh from the farm, could have taken up and successfully pursued a business without any knowledge of what had been previously done. It must have been a series of inventions and experiments. As to this first straightening board, it was on the same principle as was in use in England and France, but in construction greatly improved, so much so as to have been re-invented and patented in France as late as 1800 or thereabouts. The principle of taking the curvature out of the wire is by drawing it between stiff wire pins fixed in a board, which act to bend the wire first in one direction, then in the reverse, in a waving line, the waves decreasing or growing shorter until the last bend leaves the wire perfectly straight. The placing the pins required considerable skill on the part of the operator, and often considerable adjustment by bending in or out by strokes of a hammer. In my grandfather's original straightener, two or three first bends were made by pins permanently driven into the board; the after bends by a series of small flat steel bolts, rounded at the working ends, and slightly grooved for the wire to run smoothly in. These bolts were secured to the board by a couple of staples to each bolt. They were set in position and adjusted to give the required bends by set-screws against their ends. Immediately in front of the last bolt was set a permanent shear or cutting blade, jointed to it an upper blade with a wooden handle that the operator held in his left hand, while with a pair of pliers in the right hand he took hold of the wire, drawing straight by running his thumb on the edge of a straight-edge secured to the board to the mark indicating the length of wire required when, by depressing the handle in the left hand, it was clipped off.

As late as the year 1833, I found the pin straighteners still in use in England. One extensive wire worker was using the adjustable arrangement I have described. He called it the Sellers straightener, which he explained by saying that his predecessor had been a correspondent of Nathan Sellers, from whom he had received the plan, and at the same time the plan of his annular annealing pots, which they had not succeeded in using for the finest numbers of brass wire, which I found them still annealing over open charcoal fires, requiring great skill on the part of the workman, and even then the work was very imperfectly done. On examining their furnace, the cause of failure was evident; a uniform heat could not be had in it, nor could the degree of heat be regulated with any certainty. I made them drawings of grandfather's furnace that had been without any change in plan successfully used for over fifty years, had one erected, charged a pot, worked off a heat, to the amazement of the proprietor, who was not slow in seeing certainty where there was uncertainty and a saving of not less than ten per cent. in labor in that particular branch of his business. As England is indebted to America for annealing in closed vessels, I may have something more to say on that subject in my next.

Carley's Varnish Can.

Although especially designed as a varnish can for patternmakers' use, it can be used for a variety of other purposes, as for holding naphtha by painters, finishers, etc.

The can is made of either tin or copper, and of any desired size. The construction is such that the can is air-tight, brought about by the cover closing down into the liquid between the outer and inner sections. This not only makes the can air-tight, but insures the cover against sticking.

A recent improvement, not shown in the engravings, consists of a holder for brushes. It is made of a piece of sheet steel snapped on the edge of the inner can, with projecting fingers for gripping the brush handles.

C. R. Carley, Syracuse, N. Y., is the manufacturer.

In a paper read before the members of the Gas Institute (England), Thomas Fletcher, F.C.S., made some interesting experiments showing the remarkable efficiency in boiling water in a kettle by extending copper rods down into the fire and up into the water. Of course, it is understood that flame contact with ordinary heating surface of a kettle or boiler is impossible on account of the low temperature. By extending these rods down into the fire, they become heated hot enough to permit flame contact. Experiments of this kind are not new, and in this case their chief significance is in relation to what Mr. Fletcher believes they demonstrate as practicable in steam boiler construction—an end which he is experimenting to reach. In this case it would not be practicable to use projecting rods, so he uses webs or angle ribs rolled in the plate.

The hot weather has some unusual effects upon daily newspapers in this city. Five of the proprietors of principal morning papers are calling each other bad names quite regularly, since exciting news has become scarce. The old *Evening Post* has begun to boom prohibition. Recently it published a glowing editorial on prohibition and the prohibition party, and on the same page a prominent advertisement of "mild, mellow and delicious whiskey." Perhaps prohibition, well mellowed with whiskey, is the new-fangled reform variety.

The *School of Mines Quarterly*, published for the Alumni Association, the Engineering and the Chemical Societies of the School of Mines, Columbia College, N. Y., is a first-rate magazine for those engaged in mining pursuits. It has six editors and twenty associate editors, which is a good reason for having no editorial opinions to express.

A good many users of iron prefer Swedish bars for some special uses. It is said by Swedish importers that their brands are extensively imitated in many countries. The moral is, if a man wants genuine Swedish iron, he should be careful of whom he buys.

The *Locomotive*, published by the Hartford Boiler Insurance Company, says:

"The great influence which the circulation of the water in a steam-boiler, when it is in operation, exercises upon its efficiency, its tendency to foul up, and its liability to various annoying defects, does not seem to be fully understood or appreciated by many to whom it is of the greatest importance. Were it not for the fact that heat applied to the under side of a body of water is communicated to it, thereby expanding it and causing it to rise through the colder water above, and producing a circulation, it would be practically impossible to generate steam in the ordinary manner. The efficiency of any given area of heating surface depends almost wholly upon the perfection of the circulation of the water in contact with it. This will probably be better appreciated when it is stated that the experiment has been performed of immersing a cubical metallic box in water and heating it from the inside. The horizontal upper surface of the box generated more than twice as much steam per square foot of surface as the perpendicular sides, while the bottom or lower side generated none at all. This was due to the fact that the steam bubbles or vesicles formed in contact with the upper surface, had nothing to interfere with their prompt liberation from that surface, heated water was equally free to rise, its place being immediately filled by a fresh supply of colder water, thus forming a rapid circulation; the operation went on with greater difficulty in contact with the vertical surfaces, while with the lower horizontal surface, the steam as formed would have a tendency to hug the surface, and prevent the contact of water with it, thus effectually preventing any circulation. When these facts are appreciated it will readily be seen how essential it is to the proper performance of a boiler that the water-spaces should be large, and as free from obstruction as possible; in order that the water may have opportunity to circulate rapidly, and the steam when formed be disengaged as freely and quietly as possible.

Comparatively few years ago, it was the universal practice to crowd as many tubes into a horizontal boiler as could be gotten into it. They were set in zig-zag rows, to enable the greatest number to be put into a given space, on the theory that the more heating surface the more steam the boiler would make, and the natural consequence was the spaces between tubes, and between tubes and shells, soon became filled up with scale and sediment, the result being overheated plates, and leaky seams and tubes, while the steaming capacity of the boiler was greatly reduced. Of late years, however, the fact is beginning to be appreciated that tube surface is not heating surface, unless it has plenty of room to act as such, and consequently the number put into boilers of any given size is less; they are arranged in a more rational

manner, and as a natural result the boiler steams better, and is more easily kept clean, less repairs are necessary, and the life of the boiler is greatly prolonged.

Machinist's Bench Drill.

The drill which we illustrate herewith is designed to be set on a bench or platform about two feet in height. It has four changes of speed, and lever feed, being adapted for quick work as in manufacturing establishments.

The mandrel has standard taper hole; bearings are of gun metal, mandrel and shaft of steel. The machine will drill up to a ¾ inch hole, to the center of an 18 inch circle.

The manfacturer is W. W. Brisben, Cleveland, Ohio.

American Railway Master Mechanics Association.

REPORT OF MASTER MECHANICS COMMITTEE ON IMPROVEMENT OF LOCOMOTIVE BOILER CONSTRUCTION.

To the American Railway Master Mechanics Association:

Your committee on improvement of locomotive boiler construction respectfully submit the following as the result of their labors. With a circular of inquiry sufficiently broad to embrace the most minute improvement, and giving admittance to any and all boilers, your committee regret that very few replies have been received:

Mr. G. W. Stevens writes your committee that his company have had built by the Schenectady Locomotive Works three 18 x 24-inch cylinder, 5 foot 6 inch driving-wheel passenger engines, with boiler carrying 180 lbs. working pressure.

As the engines have only been in service a short time, nothing definite can be said of the benefit of the high steam pressure. No trouble whatever is experienced with the valve and cylinder and surfaces, and evidence is given of a fuel record that will not exceed five (5) pounds of coal per car mile, with trains of ten cars equal to 280 tons, exclusive of load, running on a schedule time of 37 miles per hour.

Mr. William Woodcock writes that nothing new has occurred in his practice during the past year, but gives sound advice in advocating steel as the best material for boilers, and, with the present tendency to larger boilers, better workmanship, and abhorrence for that instrument of boiler torture known as the drift-pin.

Mr. Thomas Twombly reports progress in larger boilers and heavier material.

Mr. Allen Cooke expresses a preference for the wagon-top boiler, of sufficient size to warrant plenty of steam.

From the work of N. P. Burgh (on boilers), your committee reproduce a return tube boiler, which is not identical, but substantially the same as the Coventry boiler, as reported in eighteenth annual proceedings of this convention. This is not presented as anything new, but to verify the remark by a member at the last annual convention that some devices were presented as new, when, in fact, they were thirty years old. In connection with this, it is interesting to note the different forms of boilers that have appeared from time to time, particularly those of a comparatively early date; they all bear close resemblance, the designers ignoring the principle of direct application of heat, and imagining that heating surface could be sacrificed, and the best results obtained, by the introduction of any distortion, evidently believing that the efficiency of the boiler was increased just in proportion to the circuitous route of the heat from the fire-box to the tubes.

Mr. J. E. Jerrold of the C. M. & St. P. Ry. furnishes your committee with drawings of his curved boiler seam, plates 40 and 50, as applied to longitudinal seams for the purpose of securing maximum strength and avoidance of concentrated strains, and kindly furnishes a letter giving the results of pressure test, as applied to steel drums, constructed for the purpose. [This construction was illustrated in the AMERICAN MACHINIST of Jan. 9, 1886].

Your committee conclude that with the return of activity in locomotive building, improvements will become more manifest; and that this association as in the past will continue in the collection and dissemination of knowledge which has made the locomotive boiler a triumph of mechanical skill and placed the locomotive in acknowledgment as one of the most economical of high speed engines.

G. W. STEVENS,
WM. FULLER, } Committee.
T. J. HATSWELL,

DISCUSSION.

Mr. Lauder—It seems to me that this report ought not to pass without some discussion. It is a matter which has been before this association for a great many years, and the interest in discussions in locomotive boilers improvements, it seems to me ought to be on the increase instead of decrease. I hope that some of the members will see fit to criticize this report, or at least to discuss it to some extent, and not let it go by default. I have perhaps been a little remiss in my duties. I do not think I contributed anything to the committee toward making up that report, but there is one little minor detail about the construction of locomotive boilers that I would like to mention, and that is, the fastening of the inside fire-box to the outside shell at the bottom, or at the mud ring, as we call it. I can see no reason why there should be any leakage around the bottom of the furnace, at the corners especially. When I see a boiler leaking at the mud ring, it seems to me that it is due to faulty design, or construction, or to some defect that should be remedied, and it can be remedied. There is no question but you can

MACHINIST'S BENCH DRILL.

make the union of the two parts of the boiler at the bottom, at the mud ring, just as strong, as reliable and as free from dangerous leaking as you can make any other part of the boiler. We do not do it. Why? Simply because we have not given the thought and attention to that matter that we ought to have done. I have commenced to do what I believe will obviate that difficulty. It is not needed so much in New England, where our water is pure, as it is in the West. But since I was railroading a short time in the West, I have been led to think more about that matter, and I now make the mud ring deeper and double rivet it. I say that if one row of rivets won't hold that joint tight and keep it from leaking at all times, put in two; if two won't hold it, put in three. If it is necessary to put in ten rows of rivets around the bottom of the boiler where you join the two parts of the boiler together in order to make it safe and free from leaking, do so; but let us get rid of the annoyance of leakage around the bottom of our furnaces. We all know it is a bad place to get at and to fix, and that it involves a good deal of time and expense to repair a leak, especially at the corners. I think that a double-riveted mud ring, so-called, will cure the difficulty. I have adopted that method of construction, and I have several boilers running which were made in that way, and, so far, they are as free from leakage there as at any other parts of the boiler.

Mr. Campbell—How do you fix the round points at the corners there?

Mr. Lauder—In precisely the same way that you would with the single-riveted ring. Of course those rivets are properly set, and the plugs are screwed from the outside. There are four in a double-riveted ring, which are tapped in to the head ring, screwed in and then headed off. There is no more difficulty in doing that with a double-riveted ring than there is with a single. It simply makes more plugs to head off.

Mr. Campbell—That is one difficulty that I have on my road—that of leaky corners in the fire-box.

Mr. Lauder—That, I think, is the usual way; it is the only way that I have ever adopted; it is the only way that I can see that it can be done, because there is so much more surface on the outside of the boiler than there is on the inside. It would be impossible to put all the rivets through and head them off on the outside, so that in the case of those that can be put through, that plan is adopted. Then on the outside they are tapped, and the screws are put into the ring, and then headed off in the usual way.

Mr. Setchel—I am a little sorry that Mr. Stevens, the chairman of the committee, is appointed on the other committee, where he is just at this time. We generally expect the chairman of the committee making a report to introduce the discussion in a way that will create interest; and I should like very much to hear from him. Mr. Stevens has recently put some very heavy engines on the Lake Shore road, which carry a very high pressure, 180 pounds of steam, to which reference was made in his report. They are, so I understand, working very successfully; and I think the members would be very glad to hear from Mr. Stevens on the boiler question. One hundred and eighty pounds of steam is a very high and very unusual pressure; and while the general tendency seems to be in that direction, it is a question of how far we can go as to pressure and yet find the material we ought to use in order to retain it properly.

Mr. Stevens—In answer to the gentleman who has last spoken, I can only reiterate what was stated in the report. To use a short term for it, the engines "get there." They have a large margin of power over the work that is required of them. I fail to see why there should be any objection to carrying a high pressure of steam when it is needed. The engines are built to run especially on heavy trains, and they run very fast.

The Minneapolis Exposition Association has a cash capital of $300,000, besides land valued at $200,000. Its stock is owned by nearly 2,500 enterprising citizens of the city, which shows the general interest taken in this great affair. The building, which is now being pushed towards completion, is of pink Mankato stone and red brick. The stone is quarry and hammered faced, and terra cotta is lavishly used in the construction with a very pleasing effect. There are three floors, each of the same size and height, having an area of about seven and a half acres. The basement will be used for heavy machinery and fully provided with line shafting and everything necessary for its exhibition in the very best manner.

Marine Photography.

BY JAMES F. HOBART.

Photography is capable of serving the marine architect to great advantage. An instantaneous picture of a vessel when moving through the water is a valuable subject for study by the designer of hulls and engine builders. To be of service as above, the speed of the vessel must be known. This data may be obtained from the picture itself by the length of vessel being known, and by a special rig for the photographer. A shutter is required which will give two instantaneous (so-called) exposures, the time between exposures being known. For instance, a vessel 200 feet long is to be photographed at speed, and while going slow, etc. One second elapses between the two exposures, and two images of the vessel appear upon the picture.

By applying a scale to the photograph we find that the vessel moved $\frac{1}{20}$ of her length in one second, or just 10 feet; by a little calculation this is found to equal about 6.82 miles per hour. The speed thus being known, the "throw of water" or position of waves on the vessel may be studied at leisure by the designer. Two images of the vessel upon the same plate interferes somewhat with the study of waves, but if a second camera be employed a distinct picture may be taken at the same time the dual view is secured, and the single view used for purpose of study, the speed being determined as before from the dual view.

Examination of Marine Engineers.

We receive numerous inquiries as to the qualifications necessary to pass an examination as marine engineer. We have referred one of these questions to Geo. H. Starbuck, Supervising Inspector of Steam Vessels for the Second District, who courteously replies. Mr. Starbuck calls attention to section 5 of the rules and regulations, which reads as follows:

No original license shall be issued to any person to act as engineer, except for special license on small pleasure steamers, who cannot read and write, or who has not served at least three years in the engineers' department of a steam vessel, or as a regular machinist in a machine works, provided that any person who has served for a period of three years as a locomotive or stationary engineer, may be licensed to act as an engineer on steam vessels after having had not less than one year's experience in the engineers' department of a steam vessel.

Inspector Starbuck further writes us:

"Except for special license for running small steam yachts and launches a person is required to have had three years' experience in the engineers' department as fireman or oiler before a license can be granted him. It is also necessary that he should understand the construction and working of the safety valves, and be able to calculate the proper weight, and the position on the lever to place it for a given steam pressure. He should also be able to calculate the steam that is brought to bear on the different braces in the boiler from the area of surface they must strengthen. He should also have a general knowledge of the construction of boiler and engine, and the functions of the several parts.

"Of course an applicant for license as an engineer on a tugboat would not be supposed or required to have as large a fund of knowledge and experience as an engineer of a river or ocean steamer.

"Then again, experience without much learning has brought many an engineer's license. The examiners in examining an applicant take many things into consideration, such as experience, practice, willingness to learn, etc., but require a general knowledge of the different parts and kinds of engines. For a special license to run a small yacht or launch the most that is asked for is a fair stock of common sense."

In almost every work on the subject may be found a reference to "perfect combustion." If some one would tell us what imperfect combustion was, it would aid in understanding what was meant by "perfect combustion." So far as is known, if there is combustion at all, it must be perfect.

When a builder specifies the coal per horse-power required by his engine, unless special reference is made, it is understood that he means coal of the best quality.

The time when "nominal horse-power" had any meaning has long since gone by. As used at the present time it means absolutely—nothing.

An old Swedish gentleman in Whitehall, Mich., spends his time gathering cancelled postage stamps, which are shipped to Sweden, where they are sold at auction for benevolent purposes. The buyers use the stamps in lieu of wall paper, and some houses there are entirely papered with United States postage stamps.—*Grand Rapids Telegram-Herald.*

A Pittsburgh genius has discovered a process for manufacturing coke from natural gas. From this coke are manufactured carbon points for electric lights, and thus is the red flare of natural gas made to contribute to the white and blinding brilliancy of electric jets.—*Oil, Paint and Drug Reporter.*

Inventory Valuation of Machinery Plant.

BY OBERLIN SMITH, BRIDGETON, N. J.

A PAPER READ BEFORE THE CHICAGO MEETING OF MECHANICAL ENGINEERS.

The keeping of cost and valuation accounts in connection with machinery has never been brought into so perfect a system as has ordinary commercial book-keeping. Recently, however, there has been a good deal of interest taken in the subject, and new light has been thrown upon keeping cost accounts by such valuable books as those of Capt. Metcalfe and others. The matter of inventory valuations, however, with which it is proposed briefly to deal in this paper, is, to say the least, in a very mixed-up condition, and, although with some machinery owners it has received considerable attention, the average method contains a good deal of guesswork.

It is evident that at the very base of all account-keeping is the finding out the true value of the property kept account of; and that without this being correct all else is useless.

Probably the most popular and frequently-used method of doing this is by pure guessing. Another system is that of taking original cost at first, and then depreciating a given percentage each year, regardless of the several modifying conditions which will be mentioned later on. One large manufacturer, known to the writer, used to work upon this system with his machine tools, depreciating their value 10 per cent. each year. Although acknowledging that it brought the figures rather too low, he said that it kept him upon the safe side, in not letting his assets appear of greater value than they really were. However safe this method may be, it is worthless if the object is to show the real value of the property. This will be apparent if reference is made to the second line of the following table, wherein $100 is shown decreased at the end of each year 10 per cent. from the remainder belonging to the year previous:

YEAR.	0	1	2	3	4	5	6	7	8	9	10	15	20
10 per cent. off.....	$100.00	$90.00	$81.00	$72.90	$65.61	$59.05	$53.15	$47.83	$43.05	$38.74	$34.87	$20.59	$12.16
5 per cent. off.....	100.00	95.00	90.25	85.74	81.45	77 38	73.51	69 83	66.34	63.03	59.88	46.33	35.85

It will be noticed that at the end of 10 years the amount is only about $35; at the end of 15 years, $20.50; and at the end of 20 years, about $12. In the third line are shown the respective amounts for $100 as depreciated 5 per cent. each year instead of 10. This gives about $60, $46 and $36 respectively, as the amounts at the end of 10, 15 and 20 years, and it is much more reasonable, for the valuation of machine tools, than is the first-mentioned discount, if a system of this kind, with a constant ratio, is to be employed at all. The absurdity is, however, apparent, of using a tool costing $100 when in such bad condition as to be worth but $12, or even $36. Such practice would be suicidal, and yet many tools need not be thrown away in 20 years.

Another method is to estimate the probable price which an article would bring at auction. This is a very indefinite way, as it is well known that there are auctions and auctions. In some of these the property brings more than it is really worth, while in others, where the proper bidders do not happen to be present, or where an article is bought for a purpose for which it is unfit, the prices are sometimes almost *nil*.

A striking illustration of the variable values which may be attached to a lot of plant may be seen by comparing the average insurance value and the average taxation value, the latter being usually a very different thing from the former, and the difference being something that frequently sadly puzzles the conscience of the owner to adjust, as it is a soothing balm to his pocket-book. The system now used of taxing machine-shop plant is very variable, and the average tax assessor is often at his wits' end to know what value to put upon such articles as patterns and special tools, even if he arrives at any fair conclusion regarding the standard machinery. The result is usually a compromise between the high guesses of the assessor and the low guesses of the owner.

It will not be necessary in this paper to dwell upon the best methods of finding the cost of machinery or its productions, but taking it for granted that a machine shop's accountants have a complete record of the cost of all its plant, whether it shall have been purchased or made upon the premises, and supposing further that said plant is new and not deteriorated by wear, the question arises, what is its value? The first and most important thing to do is for everyone concerned to get it out of their heads that value is necessarily dependent upon cost. There are many modifying conditions which prevent this being true. First among these variable conditions is commercial fluctuation of value, and this applies perhaps more to purchased articles, such as standard machine tools bought in open market, than to patterns and other special tools, etc., made upon the premises; although the latter classes have of course certain fluctuations in cost, dependent upon the labor market and the current price of materials. Thus, if an engine lathe should have been purchased a year ago for $1,000, and remaining unused, should now be assessed, its value, of course would depend upon the present price charged by its maker. A second factor in variation of values is locality. For instance, if the lathe above spoken of was to be used in a mountainous region away from railroads, it would be fair to add to its value at that place the freight and other expenses (perhaps also custom duties) paid to get it there, providing an equally good and cheap lathe could not be bought nearer at hand, where the freight would be less in amount. An appraiser must, however, be careful not to follow the rule of adding freight and custom charges to the cost of a machine, without proper discrimination as to whether it was necessary to bring the tool from a great distance or from a foreign country, instead of buying something nearer at hand. If the latter could have been done, the whole of such charges should of course not be added.

A third variable pertaining to values is obsoleteness, for it is evident that our hypothetical $1,000 lathe, even if it has been bought at the lowest market price, which has not yet fallen; and near at hand, where no freight of any amount was to be added; and is new and in perfect condition, is not worth $1,000 if a lathe can be bought for the same price which is of such superior design that twice as much work can be done with it in a given time. In this case, the first-mentioned lathe is practically obsolete, and its value might be less than nothing. This supposable case is, of course, an extreme one, but the fact is that in these days of intense inventive activity, machinery is constantly becoming more or less obsolete. In many cases, this is so only to a slight degree, especially in cases of machine tools, such as lathes, planers, drill-presses, etc. This fact is not much to the credit of mechanical engineers, but it is nevertheless a fact, that far less original design has been put into this class of tools than into many others outside of machine shops.

A fourth, and the most obvious cause of depreciation in machinery plant, is wear and tear, and there is perhaps more good judgment necessary in determining the exact amount of this depreciation than in any other part of the appraiser's work.

The grand principle which lies at the root of correct valuation, and which should govern the appraiser throughout all his work, is, that any article is worth not what it did cost, but what it would cost to replace it to-day, providing it is so useful that it would be desirable to so replace it were it destroyed. Thus, if a shop has a lot of machine tools which are built so near to the best modern practice that it would be desirable to duplicate them were they destroyed, they are worth exactly what said duplicates would now cost delivered and set up in the shop, less the depreciation due to the wear and tear. This rule also applies to boilers, engines, shafting, belting, shop fixtures, and small tools—anything, in fact, which can be bought in open market (and, for that matter, it can be applied also to buildings and ground, as well as plant). In the case of woring-drawings, patterns for castings, and other special tools, such as jigs, etc., all of which are usually made upon the premises, and whose chief cost consists in the items of labor and general expenses, together with a small amount for material, the method of obtaining the true value is of course somewhat more complicated. This is for the reason that the amount which such an article did cost is a very poor index of what it would cost to build a second one, it being usually the case that but one of a kind is needed, and no duplicate has been made. There must necessarily be some guess work in getting the value of these articles, but it is usually from 10 to 30 per cent. less than the original cost spoken of—that is, if in full use. With this class of tools, the variation of market price, locality, and wear and tear, do not occur to so great an extent as with machine tools proper, but the variation due to obsoleteness occurs in a very much greater degree than with almost any other class of property. It will be noticed above that working-drawings and patterns are classed with jigs, as "special tools." They are not always regarded as such, but undoubtedly should be, as they have exactly the same general conditions governing their use. It may be here said that a marked distinction should always be made between an original drawing and a working drawing. One of the former class may cost $1,000 to make, on account of the designing which is incorporated with it, but as a drawing it is not worth more than $10, if it can be duplicated by an ordinary journeyman draughtsman for that amount. Whatever value the designing spoken of has in itself, must be found in some other part of the inventory, under the head of "patent rights," "good will," or something of that kind, rather than in the class "drawings." A working drawing, therefore, is (and 'tis the same way with a jig) worth exactly what it would cost for a draughtsman to copy it off, plus the paper on which it is drawn. A pattern is worth exactly what the wages and general expenses would be for a pattern maker to duplicate it, plus cost of the wood, glue, varnish, or other material. The true value of a jig or templet may obviously be found in the same manner, always assuming that said articles are needed for frequent use in the regular production of the goods manufactured by the shop in question. It is evident that the value of all these classes of special tools depreciates enormously if said production is permanently decreased from regular and standard to occasional, or if the articles made are going out of fashion in the market, or are not able to compete in price with others of a similar nature. If they have become entirely unsalable from the above causes, or from having been superseded by improved articles of some other kind, then the value of the drawings, patterns, and other special tools with which they were produced is of course reduced to nothing. Great care should always be taken in appraising to rate such articles low enough so as not to show deceptively high assets, but at the same time, in justice to all concerned in the ownership of the property, they should not be put at a foolishly low figure, as were the patterns of a large manufacturing concern known to the writer, whose policy was to gradually depreciate all their patterns, until their value stood at "nothing" upon their books. This of course made them safe against showing false profits, and also had the merit of making their inventory worthless for this particular class of tools, as far as the legitimate functions of an inventory are concerned. The simplicity and ingenuity of this plan was more conspicuous than its common sense, especially after some time had elapsed, and the figures had gotten down very low. Of course if the system was right at this time, it must have been wrong at first, and to carry it out logically the patterns should all have been counted as worth nothing when they were first made.

In all jobbing machine shops, which do repairing and odd work rather than limiting themselves to standard manufacturing, there is a large accumulation of drawings and patterns (not usually, however, many jigs), which belong to what may be called "transient" jobs, and which will probably never be used again, or at any rate only occasionally. These should be valued at a very low figure, usually less than 10 per cent. of what they cost, the amount of this percentage depending upon the probabilities of their future use.

In estimating the depreciation due to wear and tear in engines, shafting, belting and machine tools, due regard should be had to the general system upon which they are run—whether they are allowed to wear themselves almost entirely out and are then replaced by new ones, of which a new inventory is taken, or whether they are kept up to a certain standard of goodness by the replacing of worn parts, etc. The latter is the system practiced by the writer for many years past, and is, in his opinion, undoubtedly the best one. Leaving out the question of obsoleteness, there is no reason why a lathe or a planer should not be run for twenty or thirty years and kept up to the standard (by frequent repairs and replacement of parts) to which it has attained in the third or fourth year of its age. Shafting and pulleys can be regarded in the same way, but can probably be kept nearer to a new standard, as they do not wear out so fast. Belting also can be treated upon the same principle, but kept at a lower standard, the average condition of a lot of belting throughout a shop usually being probably nearly half-worn out. The writer intends, for his own use, to establish for these classes of machinery, and also for small tools, such as twist drills, reamers, etc., a standard percentage of "worn-outness"—if such a word may be coined for the occasion. He has not yet made an accurate estimate of the proper percentage to be employed in each case, but probably a fair allowance for the percentage of present new value in a well equipped and properly taken care of machine shop (leaving out, as before intimated, the question of obsoleteness), would be, for shafting, etc., 80 to 90 per cent., engines and machine tools, 70 to 80 per cent., boilers and belting, 60 to 70 per cent., and small tools (which are constantly being ground away), 50 to 60 per cent. This estimate is, of course, only approximate, and its correctness would vary with the standard of condition which was adopted and the consequent thoroughness and frequency of repairs.

A properly kept inventory of the class of articles just mentioned would put them at new value the first year, and depreciate them from 5 to 10 per cent. annually, until the standard constant was reached, after which they would remain at about the same price each year, except as affected by violent fluctuations in the market, and by obsoleteness of design.

With regard to the special-tools before mentioned, the depreciation for wear and tear need be but very little, as if they serve their purpose at all, they must be kept in such repair as to serve it perfectly; and they are not a marketable article in which a slight deterioration in appearance would largely affect their value, as would be the case with standard articles. In the case of working-drawings, which are usually of trifling value, it is not worth while to take account of the wear and tear, as when worn too much for use they can be wholly replaced with duplicates, and the valuation can be kept, for convenience, at the same rate.

An excellent mental aid to an appraiser, in considering the value of doubtful articles, is to estimate what he would be willing to bid at auction for a duplicate, were the article destroyed. This amount, if correctly guessed at, is certainly a true index of the real value.

The writer has for several years past paid considerable attention to keeping a systematic inventory, in which all the property of the machine works with which he is connected is classified into "classes" and "sub-classes," so entered in tabular form that the names need not be re-written yearly, except in case of additional articles entered. In this book there is a set of columns provided for each year, for a term of years to come, so that the value merely need be entered, together with the amount of depreciation since the last year. There are proper columns provided for cost, variation therefrom to obtain actual new value, subsequent depreciation for the various causes that have been mentioned in this paper, etc., etc. He will not, however, occupy the time of the society now to describe this book in detail, though it may possibly furnish a theme for some future occasion. The object of this paper will be attained if it shall haply influence even a few among many engineers to use more systematic methods in estimating the true value of the property in their charge.

As a recapitulation of the foregoing, the rules governing an appraiser may be tersely stated thus: Rate all property that it would be desirable to reproduce, were it destroyed to-day, at the net cost of such reproduction, in its existing locality, minus its estimated damage by wear and tear. Rate partially obsolete articles the same way, but minus also a percentage of their apparent value, equal to their estimated percentage of obsoleteness or of improbability of usefulness. Rate wholly obsolete articles at nothing.

New Locomotive Valves and Valve Gear on the Chicago & Alton.

In our issue of June 26 we made brief mention of a new valve gear for locomotives, designed and then being built by William Wilson, Superintendent of Machinery of the Chicago & Alton Railroad. Under date of July 16 Mr. Wilson writes us:

"We have made three trips with the double valve engine. We run from Bloomington to Chicago with the night express, and indicated her on this train, as well as on two freight trains previous to this; one of the freight trains consisted of 49 cars. This forenoon she drew our passenger train of nine cars from Mount Forrest to Chicago—about 16 miles—working in the center notch, and increased her speed. She shows a fine card in this notch. I am inclined to believe the valves and valve motion a success."

The best way to utilize water-power and get the benefit of its cheapness is to have a steam engine ready to start when the water gets low. The Boston *Commercial Bulletin* says:

"It is often argued that the water power of Holyoke, her chief dependence, is exhausted. During eight months of the year there is water enough pouring over the big dam, which is not utilized, to run a dozen additional mills; during the other two there is enough to supply what are already there, and in July and August there is some trouble in dry seasons, but even this will in a measure be overcome, it is thought, as the water power company have expended over $100,000 inside of a year to make the dam water-tight. Admitting for the sake of the argument that there will be a shortage of water during two months of the year, even then the mills can be run by steam—nearly every mill having its steam engine—and pay less for the power than is paid in places where steam is used all the year around."

Roll Turning Lathe.

FROM THE ADVANCE SHEETS OF "MODERN MACHINE SHOP PRACTICE."

BY JOSHUA ROSE.

The perspective view represents a lathe for turning chilled rolls such as are used for paper calendering machines, and is constructed by the J. Morton Poole Company, of Wilmington, Delaware.

In the figure a roll is shown in position in the lathe. The journals of the rolls are first turned in a separate lathe, and form the guide by which the body of the roll is turned in the lathe shown in the figure. The lathe consists of a bed plate *P*, at one end of which is mounted the driving head. Upon this bed plate are also mounted three standards or vertical frames, to the two end ones of which are pivoted the binder arms shown. These frames hold the bushes at *L* and *N*, in which the journals of the roll revolve. They also carry the bar *G*, secured to the arm *W* of the frame by clamps *a*, *a*, *a*. Upon the bar *G* two slide rests, consisting of a tool rest *E*, a tool clamp *A*, and a feed yoke *B*, which is screwed up by a wrench applied to the nuts as shown on the right-hand tool rest in the figure. The binder arm is adjusted to hold the bushings *L N* (which are varied to suit the size of the roll journal) a fair working fit upon the roll journals, the bolts *S* holding the binder arms firmly against the enormous pressure due to the cut. It is obvious that the frames *W* may be adjusted anywhere along the bed plate *P* to suit the length of roll to be turned, and that the slide rests may be moved to any required position along the bar *G*. Further details of the construction are as follows:

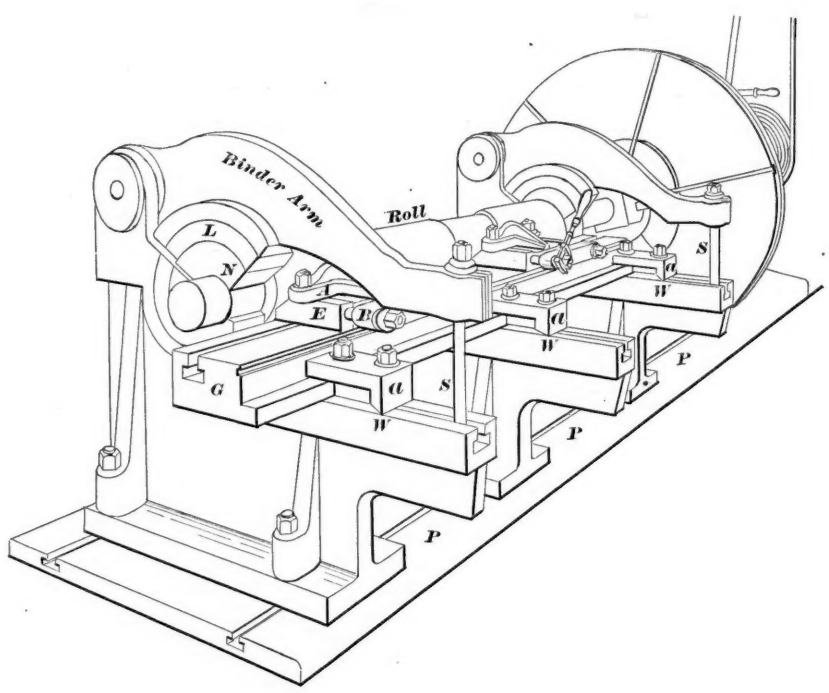


Fig. 1 is an end, and Fig. 2 is a top view of the tool rest; *A* is the tool clamp securing the tool to the rest *E*, *R* represents a section of the roll, *B* is the feed yoke, which to put on a cut is screwed inwards by operating the nuts *D*, *D*. The pins *C*, *C* are fast in *B*, and their ends abut against the tool, which is fed in under the full pressure of the clamp *A*. The tool is shown at *F* in figure 1, and also at *F* in Fig. 3, which is a view of the rest with the clamp *A* removed. The form of tool employed is shown in Fig. 4, its length varying from five to six inches. As the tool feeds in and does not traverse along the roll it is obvious that it cuts along its entire length, the cuttings coming off like a bundle of fine ragged needles.

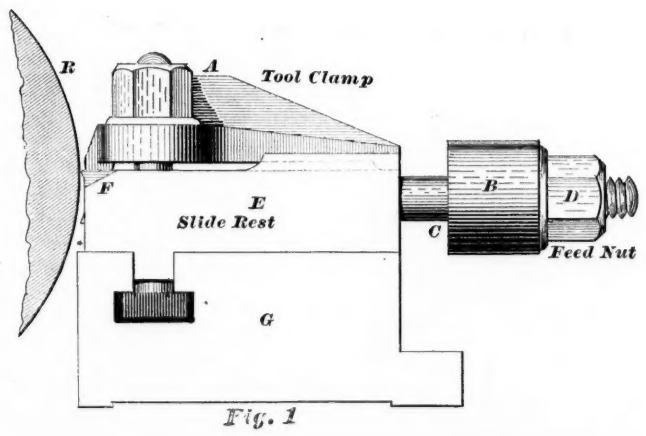


Fig. 1

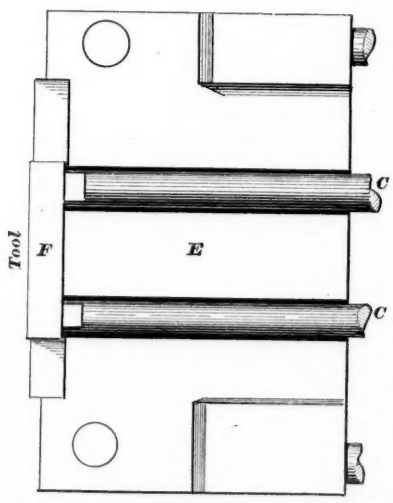


Fig. 3

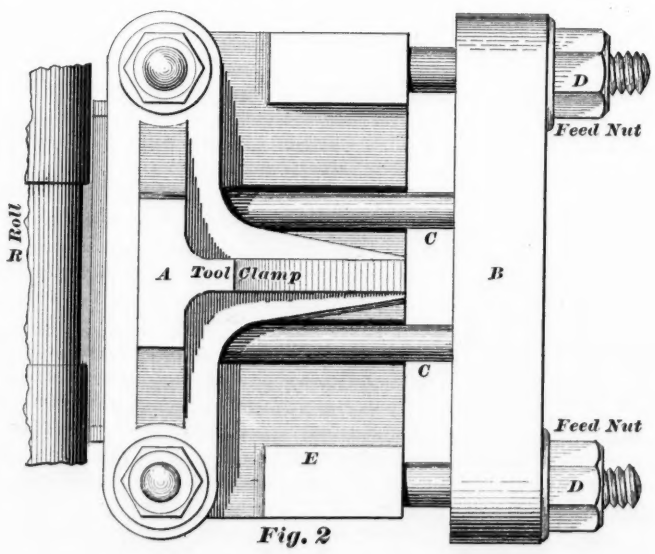


Fig. 2

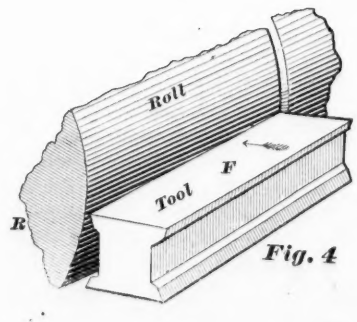


Fig. 4

When the tool has been fed in cutting the roll to the required diameter the rest is moved along the bar *G* a distance equal to the length of the tool, and the operation is repeated until the full length of the roll has been turned. It is obvious that to feed the tool in parallel, both nuts *D* of the tool rest are operated. The tool is held as close in to the rest as the depth of cut to be taken will permit, and is used at a cutting speed varying from about $2\frac{1}{2}$ feet to 5 feet per minute, according to the hardness of the roll. The tool has four cutting edges, and each cutting edge will carry in at least one cut, and may sometimes be used for a second one. The tools are used dry and the amount of clearance is just sufficient to clear the roll and no more.

The rolls are driven by a socket bolted to the lathe face plate, and containing a square hole, in which fits loosely the square end of the roll. The object of this arrangement is to permit the roll to be guided entirely by the bearings in which it rotates, uninfluenced by the guiding effect that accompanies the use of centers in the ordinary method of turning.

LETTERS FROM PRACTICAL MEN.

Mechanical Skill Increasing.

Editor American Machinist:

In your editorial, under the heading "Mechanical Wiseacres," that there had been a very intelligent treatment of the subject, has been since evidenced by the frequency with which it has been copied by other papers. That there should have been grounds for just such an article seems strange in view of the fact that we have before us constantly the most unquestionable evidence, presented in thousands of ways, tending to show that there has been for the past thirty years, not "the decadence of general mechanical skill," of which the mechanical wiseacre talks so glibly, but an improvement which has more than kept pace with all other advancement. Why should not this be the fact? With the bulk of inventors to be found among mechanics, and the thousands upon thousands of patents issued yearly, how can we suppose that there has been a falling off of mechanical brain work? Who that is familiar with mechanical operations does not know that for every invention that is patented there are many for which no patent is asked? The age in which we are living, and which is daily becoming more marked in that direction, might be called the age of prearranged mechanical methods.

The mourning because we have not the same skill to-day, in the direction of doing by hand that which no longer needs to be done by hand, but is being done by machinery—not only done better but faster—seems little short of ridiculous. "No chippers and filers; nobody who can chip a key-way as it was done thirty years ago," reaches our ears with a groan. How about this? Look into a shop with the writer with which he has been familiar for more than thirty years. That the character of the work done at this shop has been constantly improving, or, at least, has improved wonderfully in the aggregate in the past thirty years admits of no questions. Then there were employed some thirty men, now more than two hundred are employed. There were lathe hands, planer hands, vise hands, chippers and filers, finishers, etc., in those good old days when we are asked to believe that one man knew all about everything. Let any man who struck an old time boss for a job in the forties or fifties say whether he did not get asked instanter, "What part do you work at?" And let him say if he did not often fail to fill the bill because the job the boss wanted a man for was out of his line.

There were good men in the old shop, men who could do nice work with a chisel; there had to be. Shapers, milling machines, slotting machines, and other devices for taking the place of chipping, had not made their appearance. But there are good men with the chisel there yet. Why, there are some of the same men there who were there in 1850. Chipping and filing and fitting by hand has never been given up. Here is our old friend of fifty years of age, really doing better work than he did twenty-five years ago, as why he should not, with all his practice, would seem a strange question, and along side of him are young men, boys, twenty, thirty years younger than himself who are doing equally as good work.

Here is a man running a slotting machine. He has just finished splining a lot of pullies and bevel gears, a great pile of them there are too. He says: "I have splined them all to-day." "Could any man in the shop have done the same work by hand in a week?" I ask. The answer is, "No, nor could anybody do it as well by hand." Of course the man who is mourning over the sad fact that mechanics are "less skilled and competent," than formerly, is ready to say: "Certainly, that is just the point; just what we have been claiming. It can't be done by hand because you have not the men any more. Nobody knows how any more, since machines do the work, and men are only to feed, and oil, and watch the machines." Now, sir, just hold on a little. Until within a year this company, whose business is six times greater than it was thirty years ago, had no slotting machine with which to do their heavy splining. It has always been done by hand. Then there must have been—there must be now—men who are fully the equal of the men of thirty years ago. That there were in the old-times, to which the wiseacre looks back so admiringly, concerns so small, employing so few hands, as to necessitate the changing of each hand from one kind of work to another, proves nothing in favor of the old plan as against the modern division and subdivision of work, but the reverse is true.

The stickler for the old time methods would agree with us in the justice of the oft quoted saying, "Practice makes perfect," and if he stops to think a little he must admit that the very thing he is crying out against is, that men don't know how because they don't have a chance to learn. The difference between him and what he assumes is the existing condition of things, is that he wants each mechanic to know everything about his particular line of business, which he assumes was not only possible, but the rule in the old times, and is impossible, or that at best the exceptions are very rare in these days in which a mechanic knows anything of his trade beyond "how to make one or two or at most a few parts of a machine or tool, and the use of but a few machines." But, on their own line of reasoning, these men ought to admit that the greater practice on the few branches should bring greater proficiency, and if their experience has not brought with that of the writer, a constantly accumulating mass of evidence, that men in general can learn to do one thing or a few things first-class, while to learn to do more than one, or many things, often results in deterioration of quality; why then there must be somewhere different sort of men from those with whom the writer has spent his time.

Of course we common folks have a feeling of the most profound admiration for the mechanical prodigies who, being machinists, "knew the whole thing from the drafting room, through the pattern room, the foundry and the finishing room, and could set up the

tool or engine and start it working." Certainly, sir, we feel proud to do you homage, and to know that we can count such men in our ranks, even if we can't do it ourselves, and don't know it all. But, to your statement, "that not more than one in twenty-five, or safe to say fifty, machinists are anything more in point of knowledge than very young apprentices," permit me to answer that I have been in the swim for more than thirty years, and to the best of my knowledge and belief the proportion of mechanics who have a good thorough general knowledge of their business is greater to-day than formerly, and with the advantages of mechanical training schools, the improved quality of mechanical papers, and the forcing of men up to do the best of work by the improved machinery which is decried as a cause for "decadence of skill," I look forward to see the proportion of first-class mechanics increase.

What is a man thinking about? Where are his eyes, when he keeps whining because we have no workmen in these days? Why, in the working of metals, the building of machinery, we are using machinery and methods to-day which as far outdo old methods as does railroad travel outdo the old stage coach variety. Somebody must have designed and built this machinery. Somebody must be constantly exerting a mechanical skill, and inventive ability which did not exist in the much lamented good old times. But, here I run against another snag. The old time writer says, referring to modern mechanics and their skill, "There is little more than a pretence in them; the substance, in the form of real mechanical skill, is in large part or wholly wanting. They are automatons, animated machines." Yes, they are doing a sort of work which would have been as impossible to the average mechanic of thirty years ago, then, as it is to him now, unless he has kept up with the times instead of assuming that, in "learning a trade," he had learned all that there was to know. In the division of work, and use of improved machinery, not the least of the benefits derived are to be found in the constant surveillance, and the holding up to the standard of good work coming from fellow workers. And machines which it is known can and will—must—produce a certain quality, and character of work when properly treated are also most inexorable claimants for the most honest and faithful co-operation. Any lack of fidelity on the part of operatives of machinery at once makes a tell-tale of either the machine or its products. There are incompetent, and slouchy, careless, inefficient, men to-day as there were thirty years ago, and there no doubt will always be, but it seems to me that, as we have worked on the plan of prearranged methods more and more, the check upon them has been growing greater, and that the standard of mechanical skill is growing higher

Owing to the omission of a comma, and of an apparently unimportant word in one place, and the change of a word in another place, I find that my described methods for coiling springs do not convey the meaning intended.

Do the coilings without, using three rolls instead of two?" With a comma where I have placed it after the word without makes me say just what I intended. Next I am made to say, "A spring of any length required may be coiled with an arbor." What I did say, or intended to say, was "with no arbor." Again, "experiment rolling" should have the word "in" interposed.

S. W. GOODYEAR.

Reverse Lever for Locomotives.

Editor American Machinist:

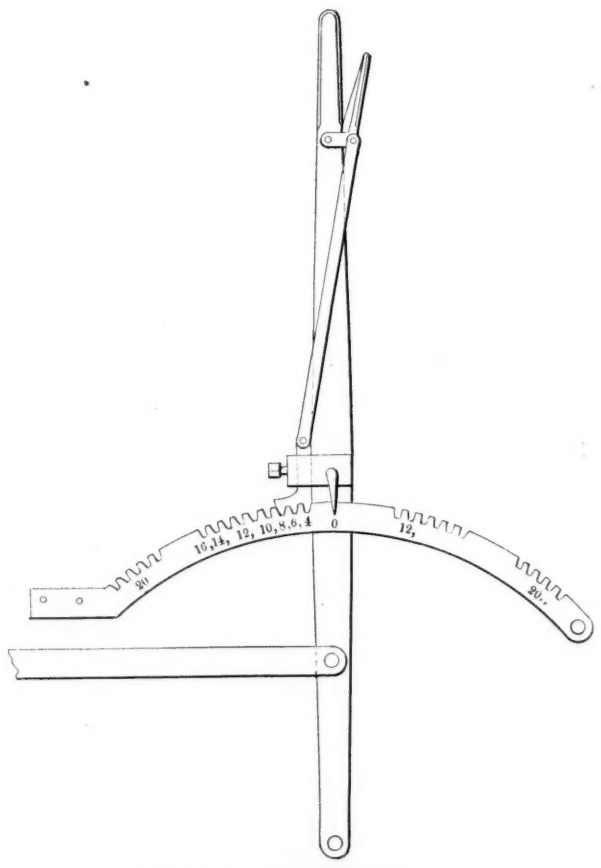
In your issue of July 10 I see that Angus Sinclair, at the Master Mechanics' Convention, puts forth a pertinent and timely argument for a reverse lever and quadrant that would permit finer graduations of cut-off. I send you a sketch of a lever and quadrant I designed (no patent) which was put into satisfactory use. The sketch is self-explanatory. You will notice that the dog is on the front side. When on the back side the weight of links draws so hard on gib-set screw that the point soon sinks into gib, resulting in lost motion. When put at the front the whole surface is opposed to the weight of links. The thumb piece can be located on either side.

The quadrant can be cut to suit individual taste. Many builders do not give the dog and notches draft. This, I think, is wrong, because when the dog bottoms in the notches there is soon lost motion, and resulting "chucking" at every stroke of the engine. When straight notches are used the dog also lifts out hard; with bevel notches it lifts easily.

A tell-tale indicates the point of cut-off, graded as fine as desired, according to construction. At the same time, with notches and teeth accurately formed, ample wearing surface is provided.

A word about the figures on the quadrant: I never saw any that were half large enough. They ought to be so large that an engineer can *feel* them at night. WM. H. BRADT.

Troy, N. Y.



REVERSE LEVER FOR LOCOMOTIVES.

Accuracy of the Poole Grinding Lathe.

Editor American Machinist:

As I leave for Europe by the Etruria tomorrow, I have but little time to reply to Mr. Smith's remarks concerning the grinding lathe. I have taken great pains to assure myself of the practical accuracy of this remarkable lathe, and I will say that I know of no other mechanical operation, or piece of work of so large a size, that is so mechanically perfect as it produces. There have been many who have failed to perceive the principles of its action; but when they saw, as I did, calendar rolls some six feet long placed before the shop doors, with all the windows shut, and could see no light between the rolls, which were quite clean and could be revolved either singly or together, and still exclude the light, there could be no question as to the accuracy of the work, especially when a piece of gold leaf, placed under one end of the roll, gave the prismatic colors like a broad rainbow. If I am not mistaken, Professor Sweet determined that the thickness of one of the pieces of gold leaf used for one of these tests was about $\frac{1}{40000}$ of an inch in thickness. The rolls I saw were not exhibition ones, but every-day work. One of them was taken out of the lathe in my presence, and its surface was a beautiful, dead-smooth polish. The work is not only practically perfect, but must be so from the construction of the machine.

Its guide-ways, being the same as any other, can be made as true as any other, and the surface of the roll is a guide to correct whatever error there might be in the truth of the ways.

Thus, suppose the carriage to stand still until the roll is ground true, and both wheels will then meet the work at the same time. Now move the carriage an inch, and let the ways be out $\frac{1}{10000}$ inch in that inch, and they will try to pull the machine wheels that much out in traveling the inch; but the surface of the roll says, "I won't let you go; I object to your following those untrue ways. I am true; follow me; and as you are suspended upon a pendulum, you can easily do that."

How can the swinging carriage be a source of inaccuracy when it performs no function, if the ways and the rolls are true, and only comes in as a correcting agent when an error appears either in the roll or the ways?

With my back turned and my finger on the swinging carriage, I could not tell from the sense of feeling whether the wheels were running or standing still. The swinging carriage is suspended on knife edges, as shown in the detail engravings.

Mr. Smith says that "if the roll is out of truth in the horizontal plane, the difference in the diameter will be equal to twice the amount it is out with the ways." This is doubtless an oversight.

In the first place, the roll can be as easily set true in this lathe as in any other; and if it is true the swinging carriage is not called upon to do anything, but, whatever error there may be in the ways, the carriage exerts its influence to correct.

The diameter to which the roll will be ground will not, at any part of the roll length, be less, and cannot be more, than the distance between the wheels.

Suppose I take the swinging frame, with its wheels complete, between my finger and thumb, and apply it, from above, to the roll, as I would a pair of callipers of which the wheel perimeters are the points. I go to one end of the roll, apply these ground callipers, suspended (in the frame) as nearly vertical as I can, over the roll, grind a space equal to the width of the wheel. I then pass to the other end of the roll, and repeat the operation. How can I grind any taper except what might be due to the wear of the wheel?

The point to be borne in mind here is that the suspension-links, being long, permit the swinging carriage to move all that is necessary to correct the error in the ways, without any appreciable effort. Suppose 200 pounds were suspended on a knife-edge by a bar, say, four feet long, and the effort required to move it $\frac{1}{64}$ inch out of the vertical will be very small. If the ways were true, there would be no motion, no effort. If they are not true, the surface of the roll becomes the guide, and the swinging carriage permits it to become the guide. "The proof of the pudding is always in the eating," and I may tell you one of the tests that were made (by Mr. Hulse, of England, I think).

Two rolls were set side by side, with their journals resting in V's. A rectangular piece of cast-iron, about a foot long, was made "dead" true and parallel. The rolls were adjusted until this piece would fall of its own weight, through the rolls, in a certain amount of given time. And the time it took, applied at the ends, and at various points along the roll, was noted, any difference obviously denoting error. The rolls, first one and then the other, were revolved in their bearings, and the test repeated. Two pieces of work that will stand this test, with the limit of error, which, if I remember rightly, was estimated to be $\frac{1}{250000}$ of an inch, can hardly be called in question, as to being practically perfect. This $\frac{1}{250000}$ of an inch was found to be caused by the heat generated by the roll bearings in revolving the lathe, although the rolls only made about a revolution in a minute, and were well lubricated. This error was afterwards eliminated by the application of water to the bearings which the rolls ran in.

Mr. Smith is under misapprehension in supposing that the roll is put in the machine just as it leaves the turning lathe, for the journals are very carefully ground before the roll goes to the grinding lathe.

Let the depth of finishing cut be what it may, and if the wheels are of equal diameter in the two cases, two wheels will have twice the wearing area that one has, and therefore, whatever amount smaller in diameter one wheel wears in the traverse of the roll, two wheels will wear half as much.

This question of the wear of wheels under such light cuts as are taken in finishing, has probably little practical importance.

On my return (sometime in September), I hope to have the pleasure of seeing some single-wheel machines, and shall doubtless find on them that high order of work that is characteristic of the establishments in which the best class of grinding lathes have found their birthplace.

JOSHUA ROSE.

July 15, 1886.

Crushed Coal for Blacksmiths.

Editor American Machinist:

What work there is left for blacksmiths can be very much aided by the use of crushed coal. Fine soft coal demonstrates its adaptability when the smith is doing work that requires a hollow fire for heating iron clean by the gas and flame, a complete breaking up of the fire when the heat is up, and a speedy making up of the fire when the work is returned, which is often the case on difficult pieces of work.

Railroad master mechanics, in their routine of duty, go into the blacksmith shop, but they go out about as quickly as they go in. They do not relish the smoke and gas. They would do a favor if they would design, and put in use, a coal crusher—say, rolls of small diameter—to crush coal to uniform size. The rolls could be located near a line shaft, and be equipped with a hopper and fly-wheel, so that when a barrow of coal is required it could be crushed in a few minutes. This would result in greater economy than they anticipate.

C. S.

A Mechanical Wiseacre.

Editor American Machinist:

Some few weeks ago I spoke of an old-time machinist putting a governor on an old-fashioned horse-power, and spoke of the general decadence of mechanical skill of the present day. I said that a good chipper and filer was almost out of the question.

I see that some one has picked me up, and calls me a mechanical wiseacre. I may be all that he says I am, but what I said is nevertheless true.

He goes on to say that there are a good many good men that think as I do—that the class of workmen, so termed, are not so skilled as they were thirty years ago. Ask any foreman or superintendent, and they will tell you that same thing. Shops are, as a general thing, working into specialties, or confining

themselves to one class of work, finding that it is their interest to do so.

Now, to illustrate: A young man wants to learn to be a machinist; he gets a position in a shop where they manufacture, say, steam pumps. After doing a little roustabout work, they put him on a drill press. He runs that until he gets heartily sick of it, and actually has to rebel before he gets another job. Then, perhaps, they set him to boring cylinders until he gets tired of that, and so it goes until the four years of the boy's time are up, and he is out of his apprenticeship. He naturally wants to try some other shop where they do a different class of work—where the tools and appliances are all different—not what he has been accustomed to. In order to hold his job, he has to work for small wages.

Now he may know all about pumps, and that is all he does know. Send him out to repair a gas engine or printing press, and what is he good for? When you try to collect the bill from the parties for whom he did the work, they tell you that your man did not know anything about a gas engine, and they had to send for a man that did, and consequently refuse to pay the bill.

We often have applications from fathers to take their boys. They say the boy is working in such or such a shop, and they keep him on one thing all the time, and he is learning nothing.

I don't wish to be understood as saying that there are no good mechanics at the present time, far from it. There are plenty of them, and always will be, but these will be taken from the rank and file of smart boys that have the snap about them. Such will come to the top every time, and from such we get our foremen and superintendents. For every fifty boys who learn the trade of machinist but one ever arrives at the position of foreman, superintendent, or starts in business for himself.

BENJ. F. HETHERINGTON.

Indianapolis, Ind.

[Our correspondent evidently refers to an editorial under the title "Mechanical Wiseacres" which appeared in our columns a few weeks since. He is quite wrong, however, in supposing it to have been inspired by the article of his to which he refers. That article was not once in the mind of the writer at the time. Our correspondent has his views, which we are glad to have him express without reference to whether they agree with ours or those of other correspondents, or not.]

Modern Locomotive Construction.

BY J. G. A. MEYER.

TWENTY-THIRD PAPER.

From Descriptive Geometry we can collect truth and principles that will enable us to solve the three following problems: 1st. That problem which relates to the intersection of a cylindrical surface and a straight surface. 2d. That which relates to the intersection of two cylindrical surfaces, when the axis of one cylinder is perpendicular to the axis of the other. 3d. That which relates to the intersection of two cylindrical surfaces when the axis of one cylinder is not perpendicular to the axis of the other cylinder. The solution of the first problem is applicable to the laying out of a manhole sheet on a sloping tank, as shown in Fig. 120. The solution of the second problem is applicable to the laying out of a dome sheet, as shown in Fig. 121; and the solution of the third problem is applicable to the laying out of a dome sheet, when the dome is to be placed on the tapered course, as shown in Fig. 122.

We will show how to lay out these sheets in the order here given.

Fig. 123 represents the manhole sheet (with the lap omitted) when it is rolled and placed in position; the line $C\ D$ represents the top of the tank, which is a straight surface. Fig. 124 represents the plan of the manhole. Here, then, we have a cylindrical surface intersected by a straight surface, or, geometrically speaking, a cylindrical surface intersected by a plane. The problem now before us is, how to develop the cylindrical surface. Our first duty is to place these two views in their correct positions. The center A, in Fig. 124, and a line coinciding with the line $b_5\ c_5$ in Fig. 123, will represent one and the same thing, namely, the axis of the cylinder, and, therefore the point A and the line $b_5\ c_5$ must lie in the same straight line $x\ y$, and consequently the point 1, in Fig. 124, and the line $b_1\ c_1$, Fig. 123, will lie in one straight line drawn parallel to $x\ y$; again, the point 9, Fig. 124, and the line $b_9\ c_9$, Fig. 123, will also lie in one straight line drawn parallel to $x\ y$. From this we learn that the plan in Fig. 124, and the elevation in Fig. 123, must be drawn in line, that is, one view must be placed directly over the other. The lines $b_2\ c_2$, $b_3\ c_3$, etc., Fig. 123, are auxiliary lines, of which there may be any number. Now, since auxiliary lines play a very important part in this and the following problems, and, in fact, in the developments of surfaces in general, a few remarks in relation to these lines may be beneficial to the reader. Auxiliary lines may be straight lines, arcs of circles, or other curved lines. But we must always recollect that a straight line is a simpler line than an arc of a circle, and an arc of a circle simpler than other curved lines; and, consequently, to save labor, we must always choose the simplest, namely, the straight line for an auxiliary line whenever that is possible, and when straight auxiliary lines will not answer the purpose, then we should choose the arc of a circle for the auxiliary line in preference to other curved lines. In laying out locomotive boiler work, the straight line will answer every purpose. In using these auxiliary lines we must be very particular to place these in their correct position; thus, for instance, the line $b_2\ c_2$, in Fig. 123, is represented by the point marked

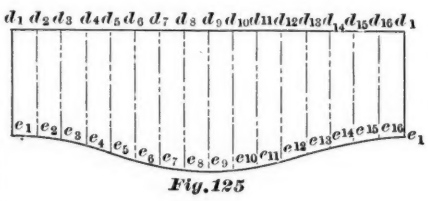


Fig. 125

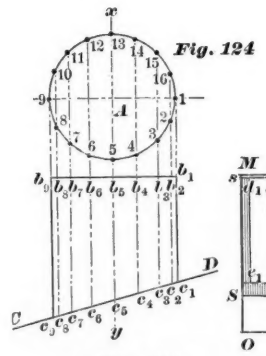


Fig. 124

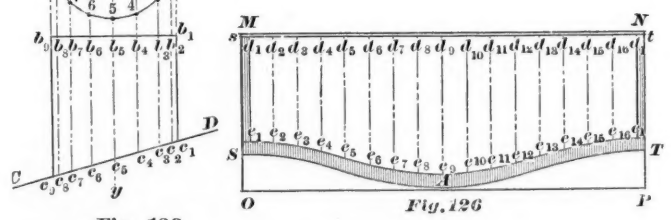


Fig. 126

Fig. 123

2 in Fig. 124; or, we may say, this point 2 represents the end of the line $b_2\ c_2$, hence the point 2 and the line $b_2\ c_2$ represents one and the same thing, and therefore these must lie in one straight line drawn parallel to $x\ y$. The line $b_3\ c_3$, in Fig. 123, and the point 3 in Fig. 124, also represent one and the same auxiliary line, and therefore these, too, must lie in a straight line drawn parallel to $x\ y$, and the same remarks apply to the other auxiliary lines. For the sake of convenience, and also to save labor, it is always best to assume that the auxiliary lines are drawn equal distances apart on the manhole sheet or cylindrical surfaces. Auxiliary lines, as $b_2\ c_2$, $b_3\ c_3$, etc., drawn on the manhole sheet equal distances apart will not appear to be so in Fig. 123; but in Fig. 124, we see that these lines are equal distances apart, because the distances between the points 1, 2, 3, etc., which represent the auxiliary lines, are equal. Consequently, to draw the auxiliary lines in Fig. 123 in the correct positions, we must first divide the circumference of the circle in Fig. 124 into the required number of equal parts, and through each point of division, as 1, 2, 3, etc, draw straight lines parallel to $x\ y$, then portions of these lines, as $b_2\ c_2$, $b_3\ c_3$, Fig. 123, are the auxiliary lines shown in the correct positions. We will also gain some practical advantages by dividing the circumference in such a manner so that each quarter of the circumference will contain exactly one-fourth of the number of parts contained in the whole circumference. Thus, for instance, if the whole circumference is divided into 16 equal parts, then the arc from point 1 to point 5 should contain four equal parts; or, if the circumference is divided into 20 equal parts, then the arc from 1 to 5 should contain five equal parts. When a circumference is divided in this manner, then each auxiliary line from $b_2\ c_2$, to $b_3\ c_3$, in Fig. 123, will represent two auxiliary lines, because when we draw a line parallel to $x\ y$, through the point 16, Fig. 124, for instance, then this same line will also pass through the point 2, consequently the line $b_2\ c_2$, Fig. 123, will represent an auxiliary line drawn through the point 2, and also an auxiliary line drawn through the point 16, the latter being concealed by the former; therefore, we say that the line $b_2\ c_2$ represents two auxiliary lines, and the same holds true for all the other vertical lines in Fig. 123, excepting the lines $b_1\ c_1$ and $b_9\ c_9$, which represent only one line. The practical advantage gained by this arrangement will be seen as we proceed.

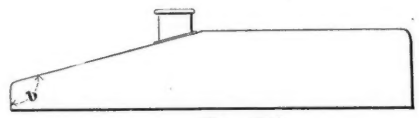


Fig. 120

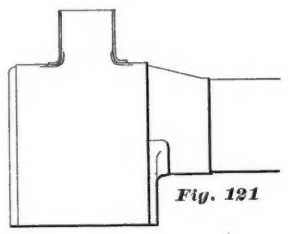


Fig. 121

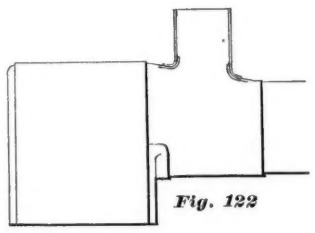


Fig. 122

Assume that on the circumference of a manhole sheet already rolled and fitted, we lay off 16 equal parts, and through each point of division we draw a straight line parallel to the axis of the manhole sheet in such a manner that these lines cannot be erased, and that Fig. 123 is an exact drawing of this sheet, with the lines drawn upon it. Now, suppose that this sheet is straightened out, then it will appear as shown in Fig. 125. Comparing the auxiliary lines in this figure with those in Fig. 123, we find that the line $d_1\ e_1$, Fig. 125, and the line $b_1\ c_1$, Fig. 123, are equal in length; the line $d_2\ e_2$, Fig. 125, and the line $b_2\ c_2$ are also equal in length, and so on. We will also find that all the auxiliary lines in Fig. 125 are equal distances apart, and that the points $d_1\ d_2\ d_3$, etc., which correspond with the points 1, 2, 3, etc., in Fig. 124, all lie in the same straight line; this must be so, because these points lie in a surface represented by $b_1\ b_9$, Fig. 123, and this surface is at right angles or square to the axis of the cylinder.

Again, we find that the points $e_1\ e_2\ e_3$, etc., Fig. 125, lie in a curved line, because the surface $C\ D$, Fig. 123, which contains these points is not at right angles to the axis of the cylinder. These remarks in regard to auxiliary lines should be carefully read by the student, and well understood, because auxiliary lines are mostly always used in laying out, not only locomotive boiler work, but various other kinds of metal work; and, again, if the foregoing is understood, the solution of each of the following problems will be found to be comparatively simple.

Example.—The outside diameter of the manhole sheet on top of a sloping tank is to be 16 inches; the metal $\frac{1}{4}$ of an inch thick; the height from c_9 to b_9, Fig. 123, 18 inches; the lap $1\frac{1}{2}$ inches, and the center of lap to be on the line $b_1\ c_1$. It is required to lay out this sheet before it is rolled to its proper diameter.

Our first duty is to find the dimensions of the plate on which the sheet is to be layed out. The length of the plate will be equal to the circumference of a circle whose diameter is $15\frac{3}{4}$ inches (that is 16 inches minus the thickness of the metal) plus the lap; hence $15.75 \times 3.1416 = 49.4802$, and $49.4802 + 1.5 = 50.9802$, say 51 inches, which will be the length of the plate. The breadth of the plate will be equal to the length of the line $b_9\ c_9$, plus the lap; hence, $18'' + 1\frac{1}{2}'' = 19\frac{1}{2}''$, which is the breadth of the plate.

HOW TO LAY OUT THIS MANHOLE SHEET.

Draw on the blackboard the two views, as shown in Figs. 123 and 124. The diameter from 1 to 9, Fig. 124, must, in this case, be equal to $15\frac{3}{4}''$; divide the circumference into 16 equal parts, and mark the points of division 1, 2, 3, etc.; through these points draw the straight lines $1c_1$ $2c_2$ $3c_3$, etc., parallel to $x\ y$. These lines will intersect the line $b_1\ b_9$, Fig. 123, in the points $b_1\ b_2\ b_3$, etc., and also intersect the line $C\ D$ in the points $c_1\ c_2\ c_3$, etc. The lines $b_1\ c_1$, $b_2\ c_2$, etc., are the auxiliary lines assumed to be drawn on the outside of the manhole sheet.

Let $M\ N\ O\ P$, Fig. 126 represent the edges of the plate on which the manhole sheet is to be layed out. Near the edge $M\ N$, and parallel to it, draw the straight line $s\ t$. Through the center of the sheet draw the straight line Ad_9 perpendicular to the line $s\ t$; on each side of the line Ad_9, and parallel to it, draw the lines $d_1\ e_1$, to represent the center of the lap, consequently the distance between the lines Ad_9 and $d_1\ e_1$ on the right, must be equal to half the circumference of the circle in Fig. 124; the distance between the lines Ad_9 and $d_1\ e_1$ on the left, must also be equal to half the circumference of this circle; therefore, from the point d_1 on the right, to the point d_1 on the left, will be equal to 49.48 inches, say $49\frac{1}{2}$ inches, which is the number of inches contained in the whole circumference of the circle shown in Fig. 124; of course, this distance must be measured on the line $s\ t$. On the line $s\ t$ divide the distance between the points d_1 and d_1 into 16 equal parts, to correspond with the number of equal parts in the circumference of the circle shown in Fig. 124. Mark the points of division $d_2\ d_3$, etc., and through these points draw straight lines parallel to Ad_9. The points $d_1\ d_2\ d_3$, etc., on the line $s\ t$ represent the points $b_1\ b_2\ b_3$ etc., on the line $b_1\ b_9$, Fig. 123, and, therefore, lines drawn through the points $d_1\ d_2\ d_3$, and parallel to Ad_9, will represent the same auxiliary lines that have been drawn through the points $b_1\ b_2\ b_3$, etc., Fig. 123. And since any one of the auxiliary lines in Fig. 126, and a corresponding line in Fig. 123 represent one and the same line, it follows that the auxiliary lines in Fig. 126, and those in Fig. 123, must be equal in length, each to each. Hence, from the point d_1, and on the line drawn through this point perpendicular to $s\ t$, lay off a point e_1 the distance between these points must be equal to that between the points b_1 and c_1; again, from the point d_2 lay off a point e_2; the distance between these points must be equal to that between the points b_2 and c_2. Or, we may say, make the line $d_1\ e_1$ equal to $b_1\ c_1$, the line $d_2\ e_2$ equal to $b_2\ c_2$, and $d_3\ e_3$ equal to $b_3\ c_3$, and so on. Through the points $e_1\ e_2\ e_3$, etc., draw a curved line. On the outside of this line draw another curved line, as $S\ A\ T$; the distance from these two curved lines must be equal to the amount of lap, namely, $1\frac{1}{2}''$. To each end of the sheet add $\frac{3}{4}$ of an inch, equal to half the lap, as shown by the shaded parts, and cut the sheet to the lines $s\ t$, $S\ s$, $T\ t$, and $S\ A\ T$.

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NEW YORK, AUGUST 7, 1886.

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Protection a Permanent Policy.

The tariff will doubtless be a live subject of discussion, both in and out of Congress, for years to come; but the danger to protection, which has seemed imminent for the last few years, has grown so small as to excite comparatively few apprehensions. Every time a new Congress has been elected, the fact has been further emphasized that the policy of this country is fully committed to a protective tariff, whichever party may have the majority. The free traders usually make a great outcry against protection after an election (they are very quiet on the subject as election approaches), and call insolently upon manufacturers to sacrifice something (in duties) to save the rest. They were louder and more confident than usual after the election of the 49th Congress, until the publication in the AMERICAN MACHINIST of Feb. 21, 1885, of nearly a hundred letters from new members, defining their position on the tariff, in answer to our inquiries, from which we figured, with the known positions of old members, a protection majority of nine, at least. This quieted apprehension, but the "tariff reformers" professed to believe that some members would change their minds. The result of the inquiry justified our saying, Feb. 21, 1885: "As to the probability of any general reduction of the tariff by the 49th Congress, it must be admitted that scarcely any apprehension should be felt." The enacting clause was stricken out of the Morrison tariff reduction bill in the 48th Congress by a majority of three; in the 49th Congress, the consideration of his reduction bill was defeated by a majority of seventeen.

The people of this country are being educated in tariff matters by the logic of events. The multiplication and enlargement of productive industries, protected by the tariff, even during business depression, convey their own arguments for a continuance of the policy under which they spring up and thrive. Every community welcomes them as public beneficiaries. None of the industries of the country are suffering from a lack of sufficient importations, free traders to the contrary notwithstanding. Many of the articles now imported could better be made at home.

The so-called "tariff reformers" pretend to favor the workman who has nothing but his labor to depend upon. They want duties levied exclusively for revenue. Their plan would make about everything imported in considerable quantity pay duties, except "raw materials." Tea and coffee would be taxed as well as many other articles in common use that are now on the free list, which would certainly raise their cost to the consumer. Wages would come down, and the kind of "relief," the workman would get would be to pay more for his everyday necessities, and get less for his labor, when he should be fortunate enough to be employed. The protection policy is to exempt everything from duty that necessarily must be imported, laying all duties upon articles of the kind produced here. It calls for placing the heaviest tariff upon objects involving the most labor, so as to avoid competition with the lower wages of foreign workmen. It is the policy that has built up the manufacturing industries of the United States, and there is evidence enough that the people propose to sustain it.

Government Work.

What would be thought of a large manufacturing concern which shut up shop for a month or two twice a year because the directors, attacked with a spasm of economy, failed to provide for paying the wages of the workmen? This is practically what is done at the Brooklyn Navy Yard, and it represents the average practice in Government works. No private works would expect to keep desirable workmen if they enforced two or three months' idleness every year, with plenty of paying orders on their books; that is if they closed up their works for the effect such an economical streak might have on the stockholders. If there is no better way than the one universally practised in Government mechanical operations, those who advocate closing up all Government navy yards for good have the best of the argument.

With the facilities that the Government can easily furnish for doing such work as is done at the navy yards it could be done cheaply, but with the present red-tape management, and a cessation of work every few days for lack of funds to pay the workmen with, the cost of the work done is enormously above what private yards would contract to do it for.

Probably it is cheaper to close up the Government yards and get all work done outside than to reform present practices. It is certainly better to do so than to continue present practices. When we put the inevitable treatment—so far as being laid off without cause—of mechanics in our navy yards alongside the standing jokes about the easy way which they take things, one may be made to explain the other without going beyond reason. Navy yards are places in which to spend a certain amount of money, not places in which to get a certain amount of work done at reasonable cost. Workmen can see this as well as politicians.

Defying the Law.

Twelve hours a day without any stop for dinner is the rule under which some of the employes of the elevated roads in New York city say they have to work. This is, of course, in violation of the recent law of the State of New York, regulating the hours of labor of railroad men, but so small a thing as the law is never allowed to stand in the way when great corporations are concerned. "Well, if the men do not like the work, let them try it on the law," is the answer said to have been made by one of the hired men employed by those who manage the elevated roads—employed to stand between the directors and the working employes of the road.

We doubt the policy of such management—a great corporation defying a law which every sensible man recognizes as humane. Sometime this corporation will be sure to find "the gun was loaded." Then they will appeal to the courts to protect them against the consequences of their own foolishness.

The Belgian Government is about to apply metal ties to its railroads in considerable quantities. There are three forms to be used—one is an inverted trough terminating in sharp edges instead of flanges. It is bent and thickened where the rail beds into it. The second form is similar to the first but deeper and is more easily rolled. The third form is built up of two channel irons placed with the web vertically and the flanges outside riveted over two wide and rather long plates at the end and having on the top thick ribbed and inclined bearing plates where the rails are seated.

Literary Notes.

"The Labor Problem" is the title of a new book of over 300 pages edited by Wm. E Barns and published by Harper & Bros., of Franklin Square, New York. Of its eleven chapters six are devoted to a symposium on several phases of the labor question which originally appeared in the *Age of Steel*. The other five chapters are essays written in the usual magazine style. The real pith of the volume before us is in the symposium which is composed of letters, each written in answer to seven questions relating to strikes and lock-outs, arbitration, wages system, profit sharing and co-operation. The letters from manufacturers, prominent workmen in trade unions, and chiefs of labor bureaus will especially repay perusal as coming from those who have had practical experience in labor matters. The views of divines, political economists and journalists find public expression so often that they are of secondary interest in this volume. The views expressed are quite diverse, and anybody but an anarchist or a "bloated monopolist" can find something to agree with. Here are a few of the expressions:

Charles Ridgely, President of the Springfield Iron Co. and Ellsworth Coal Co. says: "I think that there will be more and more difficulty in the management of labor, and that our population will become more and more turbulent. The trouble is too deep to be reached by any change of method in dealing with labor." Perhaps Mr. Ridgely has had experience with imported contract labor. If that importation is kept up we believe his views upon increasing turbulency are well founded.

N. O. Nelson, President of the N. O. Nelson Manufacturing Company, of St. Louis, writes: "Millions of able and intelligent men, citizens of a bountiful country, will not complacently see their families hungry while they are willing to work for the bread and clothing and house room which is superabundant, and they will not look too scrupulously at the tenure of title by which a few men have secured so great an advantage. * * * The payment of fair wages will, as a rule, obviate strikes."

A. H Danforth, Vice-President and General Manager of the Colorado Coal and Iron Company, says: "The same traits of character which produce wars among nations cause labor strikes and lock-outs," and closes his letter thus: "The aggregation of wealth in a few hands, coupled with discontent among the masses, are incompatible with republican institutions, and safety lies in some middle ground between an aristocracy of wealth on the one hand and socialism on the other."

Joseph Corns, Sr., of Joseph Corns & Son, Massillon Rolling Mill, says: "Workmen properly treated will seldom if ever strike—that is my experience. The bitterness now existing is the result of continued oppression and retaliation, first by one side, then the other, and until all this can be changed the fight will go on."

J. F. Darnall, President of the Greencastle (Ind.) Iron and Nail Company, writes: "The great cry of the age is 'cheap goods,' which means cheap labor. Both are coming, and much of the resistance offered is fighting the irresistible."

J. G. Batterson, of Hartford, President of the New England Granite Works, puts himself on record as follows: "Whether capital or labor deserves the higher consideration at the hands of Congress or any other law making power, is at this time an unfortunate question."

A few pages further on we find a letter from Robert Bennett, Master Workman of the Illinois Knights of Labor, who starts off by quoting the following passage from Abraham Lincoln's first message to Congress: "There is one point to which I desire to call the attention of Congress and the people. It is the attempt that is being made to place capital upon an equal footing with if not above labor in the structure of Government. * * * Labor is prior to and independent of capital. Capital is but the fruit of labor and never could have existed if labor had not first existed. Therefore labor deserves much the higher consideration."

Our correspondent, C. W. Crawford, of the Brazil (Ind.) Foundry & Machine Works, says: "It is no argument against co-operation that it sometimes fails. Other business concerns fail sometimes. It all depends on the economical management of the head of the concern, whether there are fifty owners or only one."

The book, as a whole, is the most interesting upon the labor question that has been published for a long time.

Hon. F. W. Palmer, ex-member of Congress, and formerly editor-in-chief of the Chicago *Inter-Ocean*, has taken the position of editor of our esteemed contemporary the *Industrial World* of Chicago. Mr. Palmer is a newspaper man of ability and wide experience, and the *Industrial World* is one of the very best publications of its kind in the West.

The *Master Steam Fitter* is a new monthly published by the Engineers Company, 181 Broadway, New York, at $1.00 a year. The first number has 34 pages, and is well made up and finely printed.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(284) E. D., Keokuk, Iowa, writes: Suppose a crank-pin 4" long and 2½" diameter requires a pressure of 15 tons to force it to place. Could a good man, with a sledge that he could handle to the best advantage, drive it in? *A.*—Yes.

(285) Engineer, New York City, who asks for information about hardening drop dies will find it in our issue of Dec. 19, 1885.

(286) R. A, San Francisco, Cal., asks: 1. Is a radial car axle actually in demand by railroad managers? *A.*—We do not think there is any demand for radial axles. They have been tried time and again, but are not looked upon with favor. 2. What are the defects of the present system of wheels and axles? *A.*—The system in use on American roads is very good indeed. There is some slipping of wheels and crowding of flanges on curves, but on the whole it is an excellent mechanical arrangement. 3. What is the advantage of independently connecting wheels under a car? *A.*—The advantage of one loose wheel is the avoiding of slipping on curves. 4. Who was the last to take out patents in this line? *A.*—We cannot say. Numerous patents have been taken out during the past 15 years, and we should say that the fact that railroad men do not want anything of the kind was very fairly demonstrated. It is not probable that anyone unacquainted with railroading will succeed where old railroad men have failed.

(287) M. D. B., Litchfield, Conn., asks: 1. What is the rule for finding the twisting strain of a square bar of wrought steel, the length and diameter of bar and the distance at which the force is applied being given? For instance, with a bar 18 " long, 1" square, one end being rigidly held, what force can be applied to a 6" pulley on the other end before it will twist to any appreciable extent? *A.*—The formula given by Box is:

$$T = \frac{L^2 \times l \times w \times 6}{S4 \times Mt}$$

In this, T = the descent of weight in inches applied at the given leverage (in your case, 3"); L = the leverage in inches; w = the weight; l = the length of bar in inches; S = the side of square; Mt = multiplier derived from experiment. The value of Mt is taken as 10,674,540 lbs. 2. What should be the proportion of square and round bars to resist torsion equally? *A.*—According to Box, comparing the side of the square to the diameter of the round section, the proportion should be 1.6 to 1. We refer you to this author for a complete explanation of the matter. 3.—We have an hydraulic ram with a 2' drive pipe, while a 1¼" pipe is called for by the manufacturers. Is this right? *A.*—These things are determined by experiment. It is safe to assume that the makers are right. If you write to them they will undoubtedly tell you, from experiments, what the effect will be of increasing the size of pipe. 4. Given a perpendicular pipe, with no obstruction, water flowing into the upper end. Will increasing the length beyond about 35 feet increase the quantity of water discharged? *A.*—Yes. Haswell puts this very clearly, as follows: "The discharge of a fluid by a vertical pipe is augmented on the principle of the gravitation of falling bodies, consequently the greater the length of pipe, the greater the discharge of the fluid."

(288) A. W. L., Allegheny, Pa., writes: A says that a spring made from 1-16th inch steel, 9 inches wide, coiled up like a clock spring, will propel a boat—screw propeller—12 feet long and 4 feet wide at a speed of 4 miles per hour. B. says that it will not. Which is right? *A.*—No doubt such a spring can be made to get up the speed named, but it will not maintain it long enough to be of any practical use.

(289) P. C., Brooklyn, N. Y., writes: I have a Worthington pump, and the valve is about ¼" away from the seat at one end. Could I put a spring against the cover to keep the valve to its seat? *A.*—No spring is necessary or desirable. If there is anything about the valve stem that tends to hold the valve away from the seat, remedy it. There is the weight of the valve and the steam pressure to hold the valve to its seat, which is a good deal more than is necessary.

(290) M. R., Whitman, Mass., asks: What is the power of a boiler 3 feet in length by 10" diameter, with 5 tubes 1" diameter and 2 feet in length? *A.*—If, as we suppose, all the products of combustion pass through the five 1" tubes, you may get about one-quarter of a horse-power by considerable crowding.

(291) S. E., ———, writes: My engine cylinder is 7" diameter. What will be the total pressure against piston? *A.*—The area of a 7" piston is 38½". For total pressure, multiply this by the pressure per square inch in the cylinder. 2. Can I pump soda into boiler from cold water barrel, and is it necessary to blow out all the water to clean out? *A.*—You can pump soda from water tank; clean out the same as if soda is not used. In using anything of this nature in a very dirty boiler, it is always wise to look closely at first that dirt is not precipitated over the fire surfaces, with the result of burning them. 3. Will one year's experience with full control of engine and good success be much of a recommend towards getting a better job? *A.*—It will no doubt have some influence. 4. Is it any detriment to the flues to leave fire-door open in case of steam getting high? *A.*—It is a plan considerably followed, but not to be recommended. The proper way is to close damper.

(292) W. P., Whitman, Mass., asks: What should be the sizes of ports and bridges, lap and travel of valve for a 4"x6" engine, to run at 200 revolutions with steam pressure 80 pounds? *A.*—Steam ports, ⅛"x3⅛"; exhaust port, 1"x3⅛"; outside lap of valve, 7-16"; inside lap, 3-32"; travel of valve, 1¼"; bridges, ½" will do very well.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

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"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See July 24, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

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Wanted—Numbers 1, 2 and 4 of volume IV., 1881; must be in excellent condition for binding, if soiled we cannot use them; for copies described as above we will pay 25c. each, and prefer to have the whole three if possible. Parties favoring us will kindly write name and address on wrapper. AM. MACHINIST Publishing Co., 96 Fulton street, N. Y.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES.

Citizens of Baker City, Oregon, will build a $10,000 foundry and machine shop.

R. H. Coleman is preparing to start a foundry and machine shop at Lexington, Va.

Weaver Bros., Morrison, Ill., are reported as about to start a file factory.

Iguez, Fauz & C. I. Stepheson are working up a $50,000 blast furnace at Knoxville, Tenn.

S. B. Amidon's machine shops at Staffordville, Conn., recently burned, will be rebuilt at once.

The Warren Woolen Co., Staffordville, Conn., will rebuild their mill recently burned.

It is reported that the Illinois Central Railroad Company talk of moving its shops to Kankakee, Ill.

The Flint & Walling Mfg. Co., of Kendallville, Ind., have commenced work on a new foundry.

Whitcomb & Co., Worcester, Mass., will build an addition to their envelope factory, 100x75 feet.

The New Haven (Conn.) Carriage Co. will build a new factory, 260x40 feet, with an addition 152x29 feet.

The Michigan Wire and Iron Works, of Detroit, are building a two-story factory, 54x300 feet, to cost $14,000.

It is rumored that the Louisville Stove Co., Louisville, Ky., will start branch works at Birmingham, Ala.

The establishment of a furniture factory, with a capital of $20,000, is being worked up at Salisbury, N. C.

A new mill for the manufacture of fancy cassimeres is to be started at Staffordville, Conn., by Cyril Johnson and A. G. Eaton.

It is reported that a company is being organized at De Land, Fla., with $50,000 capital, to establish agricultural works.

S. S. Badger will erect a three-story factory at 1701 Clark street, Chicago. It will be 50x136 feet, and cost $15,000.

The Hartman Steel Co., Beaver Falls, Pa., are erecting a two-story building, 40x150 feet, as a wire mat factory.

New York parties have taken the old cotton mill at Harrisburg, Pa., and will fit it for the manufacture of silks.

The York Iron Co., Minneapolis, Minn., have built a charcoal blast furnace at Black River Falls, Wis. O. A. Pray is treasurer of the company.

Lima, Ohio, has contracted with the Holly Mfg. Co. for two Gaskell pumping engines, of 3,000,000 gallons capacity each, for their new water-works.

The Lehigh Zinc and Iron Company, of South Bethlehem, Pa., have decided to erect an iron foundry in connection with their present works.

The water in the Merrimac river, in New Hampshire, is very low, causing apprehension among the manufacturers who depend on its power.

The Sweetwater Batting Co., Sweetwater, Tenn., have purchased machinery for a new cotton batting factory in that place. W. H. Gillette will have charge.

R. C. Snowden, of Elizabeth, has purchased a large lot of land in McKeesport, Pa., on which he will erect a factory for the manufacture of iron shingles.

The Lehigh Valley Silk Mill, at South Bethlehem, Pa., is almost fully equipped with its machinery. It will make broad silks. The owners are Messrs. Lipps & Sutton.

A. Aller, 109 Liberty street, New York, has issued a new illustrated catalogue and price-list of Korting exhaust steam induction condensers for steam engines and pumps. It is illustrated, and gives just the information a steam user wants to know.

A woolen mill is to be constructed, at a cost of $200,000, at Sangerville, Me. The enterprise will be exempted from taxation for ten years by the town. D. R. Campbell and J. B. Days are the owners.

The St. Louis *Age of Steel* says: "The restoration of the ten-hour rule of work at local boiler works, on the 1st inst., was attended with no difficulty whatever. The eight-hour plan was in vogue about a month only."

"I want to get something to put in a hole that will keep wood from squeaking when it turns around," wrote a piano-case manufacturer to the Dixon Crucible Co. They sent him, of course, plumbago, otherwise called graphite.

Lindsay & McCutcheon, Allegheny, Pa., are at work on that part of their building which was destroyed by fire some weeks ago. The new structure will be made entirely of iron, and will be about 250x80. The cost will be about $15,000.

F. C. Bates is to build a mill 40x100, three stories high, at Newport, Vt. Mr. Bates says if the town votes not to tax the capital invested, he will furnish veneer stock for the market, and employ over 40 hands in the enterprise.

Barcus, Duthie & Parks have opened a new machine shop at Allegan, Mich. They will design and build special machinery to order, and and will also build some patented machines for railroad repair shops. They are also agents for wood-working machinery, boilers, engines and supplies.

A certificate of organization has been issued to the L. W. Pond Machine Co., of Worcester. The capital stock is $30 000. Hon. Charles B. Pratt is president, and Mr. Henry C. Fish treasurer. They will do business at the Powell machine shop on Union street.—*Worcester Spy.*

An effort is making to raise $25,000 in the town of Toronto, Ohio, near Steubenville, for the purpose of erecting a nail mill. The gentlemen who ask the citizens to do this are not residents of the place, but agree to furnish the remainder of the capital, and put up the mill.

The Baldwin Works are building a locomotive engine for the Cairo Short Line that will be a monster in the way of dimensions and pull powers. The weight will be 94,000 pounds, with 19" cylinders and 24" stroke. More of the same kind will be put in service on the Short Line this summer.—*Master Mechanic.*

The engine of the Reading Iron Works rolling mill, which was hauled in a wagon all the way from Pittsburgh to Reading half a century ago, and was in constant use ever since, has been taken out of the mill, and its place is to be taken by a new and larger engine, which has been built at the Scott foundry.

Negotiations are pending between the Mahoning Valley Iron Co., of Youngstown, Ohio, and Cleveland, Brown & Co., of Cleveland, owners of the Russia mill at Niles, for a lease of the plant. They desire to lease it for making sheet iron, having more orders than they can fill with the present capacity at their mills at Youngstown.

The Pond Engineering Co., of St. Louis, Mo., will furnish the steam plant for the water works at Crawfordsville, Ind., consisting of two steel boilers 66" diameter by 16' long, with furnaces, etc., complete.

The Pond Engineering Co., of St. Louis, Mo., have been awarded the contract for the pumping engines for the New Philadelphia, Ohio, water-works. They will be of the Blake duplex type, having a capacity of 2,000,000 gallons per day.

Freeborn G. Smith, of Brooklyn, N. Y., has just awarded a contract to a builder in Washington, D. C., for the erection of a $20,000 factory on Pennsylvania avenue, near E street, where he will make pianos for the Southern trade. The building is to be 200 feet long, 25 feet wide, 4 stories high, and is to be equipped with all modern improvements.

Thomas Breen, of Knowlton, Pa., writes thus to the *Baltimore Manufacturers' Record:* "In regard to the proposed car works at Portsmouth, Va., I will say that if the people of that town will subscribe $100,000 worth of the stock of a new car company that is proposed to be organized with a capital of $600,000, to establish works in some part of Virginia, they will be located in Portsmouth. The other $500-000 will be furnished by other parties."

By the recent change in the executive management of the Dickson Mfg. Co., noted last week, Jas. P. Dickson becomes president of the company, and general manager of its three large shops at Scranton and Wilkesbarre, Pa. The locomotive shop will continue to build railroad engines, while a number of important specialties will be pushed at the other shops, including, among others, the building of the Dickson-Corliss engine, and the Brotherhood engine.

The terms of the proposition by which the Dueber Watch Case Co., of Newport, Ky., is to move its establishment to Canton, Ohio, in connection with the Hampden Watch-Works Company, of Springfield (which concern Mr. Dueber recently purchased), in consideration of $100,000, twenty acres of land, and exemption from taxation for ten years were fulfilled recently by Canton, and great rejoicing throughout the city was the result. The Dueber and Hampden companies collectively employ about 1,100 men. With their new location their working force will be greatly augmented.

The Pittsburgh Bessemer Works are making the largest run on record. They are turning out over 600 tons of metal per day with their two 4-ton converters, and are surprising the entire industrial world. This is said to be due to fine practice and good management. Prior to the first of the year the output from these two converters never reached beyond 450 or 500 tons, and this was thought to be a wonderful run. With the beginning of the new year, however, this was changed. Every available method to save time was utilized. Not a minute is lost by any man, and the handling of the metal has almost reached perfection.—*American Manufacturer.*

The Calera Furnace and Charcoal Co., organized at Montgomery, Ala., with the following officers: J. W. Dimmick, president; Dr. H. M. Pierce, of Nashville, general manager; Campbell Brown, of Tennessee, vice-president; C. A. Lanier, secretary and treasurer; directors, G. W. Dimmick, Campbell Brown, Dr. Pierce, J. R. Adams, W. L. Chambers, A. T. London, O. O. Nelson, J. H. Moore, and J. B. Gaston. This company begins immediately the erection of 48 charcoal kilns and one 50-ton iron furnace. The works, immediately after being erected, will manufacture 2,400,000 bushels of charcoal, 120,000 gallons of alcohol, besides resin, turpentine, and tartrate of lime.

The Babcock & Wilcox Co. have lately placed boilers with the following parties: Brooklyn Bridge, second order, 208 H.P.; Westerly, R. I., Water-Works, 90 H.P.; Lehigh Coal and Navigation Co., Pennsylvania, 208 H.P.; Edison Lamp Co., Newark, N. J., second order, 104 H.P.; Excelsior Needle Co., Torrington, Conn., 61 H.P.; Huguenot Mills, Greenville, S. C., second order, 50 H.P.; Welham Plantation, Louisiana, 240 HP.; Narks Bros., Philadelphia, second order, 45 H.P.; Bird-Coleman Furnaces, Cornwall, Pa., second order, 960 H.P.; Columbus Steel Co., Columbus, Ohio, 480 H.P.; Benedict & Burnham Mfg. Co., Waterbury, Conn., second order, 156 H.P.; Cardenas Refinery, Cardenas, Cuba, third order, 208 H.P.; Mt. Houmas Plantation, Louisiana, 240 H.P.; Southwood Plantation, Louisiana, 272 H.P.; Dakota Apartment House, N. Y. City, third order, 240 H.P.; Edison Lamp Co., Newark, N. J., third order, 104 H.P.

The Brown & Van Arsdale Mfg. Co. have sold to the Chicago & Evanston Railroad eight acres of ground at Grand Crossing, Ill., upon which they will at once erect their new works for the manufacture of seamless thimble skeins, silver-polished sad-irons, tinsmiths' tools, hub-reaming machines, and general machine work. The following are the dimensions of the ground plans for the new works: blacksmith shop, 60x125 feet; machine shop, 75x100, both two stories high; warehouse, 77½x125; foundry, 100x180; and boiler and engine room, 64x40 feet. There will be two boilers, 60 and 25 horse-power each, and two engines of 80 horse-power. There will be an additional boiler for use in case of accident to the engines. Two cupolas, having a capacity of 50 tons per day, will be placed in the foundry, and there will be track communications with the Illinois Central Railroad to facilitate shipping contracts with the Lake Shore and Pittsburgh & Fort Wayne roads. The company expect to have their new plant ready for occupancy by Oct. 1, and will employ 300 men. The cost will be $50,000.—*Chicago Industrial World.*

Machinists' Supplies and Iron.

NEW YORK, July 22, 1886.

The market has been dull and quiet during the past few days, and the new business in hand is not very extensive, being mostly from consumers who have not contracted for their supplies.

Iron—Foundry irons and Bessemer pig are produced and consumed in considerable quantity. There is but little accumulation of both foundry and mill grades, a fact encouraging to sellers, prevailing dullness to the contrary. We quote standard Lehigh and North River brands $18 to $18.50 for No. 1 X Foundry at tidewater; $17 to $17.50 for No. 2, and $16 to $16.50 for Grey Forge.

Scotch Pig—Market firmer, prices slightly higher, owing to an advance in ocean freights, but no improvement is shown by the demand. We quote Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.50; Eglinton $17.50 to $18; Langloan, $19.50, and Dalmellington, $18.50.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Position as foreman, by an experienced machine-shop foreman. Address, West, AM. MACHT.

Wanted—Correspondence with parties wanting machine-shop foreman. G. E. C., AM. MACHINIST.

Wanted—A first-class pattern-maker on engine work; none other need apply. Address McEwen Bros., Wellsville, N. Y.

Wanted—A position by an experienced foreman pattern-maker; references given. Address Experience, AM. MACHINIST.

Wanted—A man that is a good machinist, and understands building wire nail machines. Address Wire Nail, AM. MACHINIST.

Wanted—Situation as foreman of machine shop, by an experienced man; had large experience in building automatic engines, etc.; age, 32; first-class references. Address "Automatic," AM. MACHINIST.

Wanted—Good moulders for cylinders, fly-wheels and other heavy work; none but first-class moulders need apply. Address Wm. Bayley & Co., Milwaukee, Wis.

Traveling salesmen handling engineers' and mill supplies, can make desirable arrangements to sell "Eureka" packing. Special pocket-book of samples furnished. Hine & Robertson, 12 Cortlandt st., N.Y.

A mech. engineer and draftsman, thoroughly competent, with varied experience in designing and construction of engines, boilers, machinery, structural work, etc., is open for engagement. "M. E," AM. MACHT.

Wanted—Traveling salesmen selling to steam users, machinery and mill supply houses and the hardware trade, to write for my terms and commission on some fast-selling articles. Address J. L. K., AM. MACHINIST.

Wanted—A first-class machinist to take an interest in an established iron works in a Western city; no capital required; must be acquainted with engine and boiler work, and capable of taking charge of mechanical part of business. Address "Western," AM. MACHINIST.

Superintendent for bolt factory wanted as soon as possible; A No. 1 mechanic, with practical experience, can be assured permanence, if temperate, with liberal pay, in a first-class shop, where every advantage gained by new machinery will favor merit and executive ability. Die-maker wanted also; confidential replies, giving references, may be addressed to P. O. Box 257, Pittsburgh, Pa.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent solid lubricant, clean, durable, cheap; prevents hot boxes. Crescent Mfg. Co., Cleveland.

The Crescent automatic grease cup is adapted to every service. Crescent Mfg. Co., Cleveland, Ohio.

Steel stamps, stencils, burning brands, and brass checks. T. M. Parker, Hartford, Conn.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

For Sale—A 7′ swing face-plate lathe; low price. J. A. Stowell, Leominster, Mass.

For Sale—A Berryman heater, 18′ x5′, 6″ high; but little used; in perfect order. Edward J. Moore, 49 N. 7th street, Philadelphia, Pa.

For Sale—The right to manufacture the Neuert automatic engine. The best now in the market. Address Jacob Neuert, Sandusky, Ohio.

Send for estimates of high-speed compound enginss for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E.D., N.Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Wanted—A practical machinist, with some capital, to take partnership and entire charge of a machine shop equipped with new tools; a foundry doing a large business will be run in conjunction with same. Murray & Stevenson, Anniston, Ala.

M. Martin, manufacturer, P. O. Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

MISCELLANEOUS WANTS.

Advertisements will be inserted under this head at 35 cents per line, each insertion.

To Rent—Desirable space, 8x10, in light, well-fitted office; heart of machinery trade; $12 per month. Hine & Robertson, 12 Cortlandt st., N. Y.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

Wanted—A first-class man, with strictly temperate habits, to buy ⅓ or ⅙ interest in sash, door, blind and furniture factory; well equipped; desirably located between two trunk line railroads; fine opportunity for the right man to take charge of and run the business: all new machinery; entire plant and grounds worth $12,000. Address T. M. Draper, Oxford, Ala.

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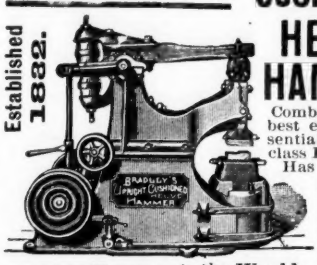
Established 1832.



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To Pattern Makers:
IF YOU WILL ATTACH A
MASSEY'S E & K PATENT VISE
To your bench, and it does not satisfy you,
Saving Screwing,
Jaws Always Parallel, Instantaneous Grip,
Saving you more Time and Labor in two months than will pay for its
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YOU MAY RETURN IT AT MY EXPENSE.
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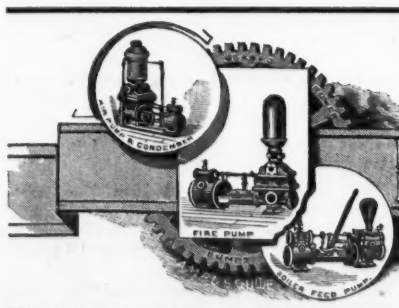

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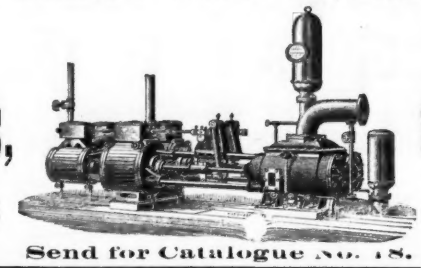

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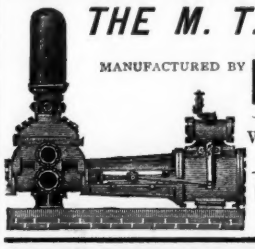

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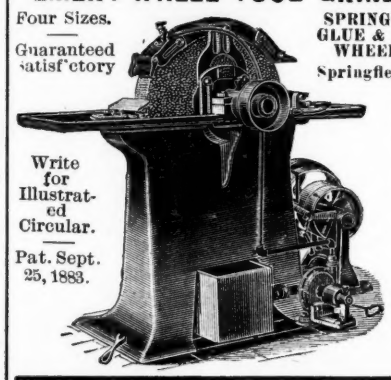

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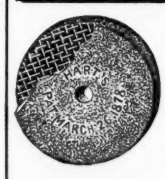

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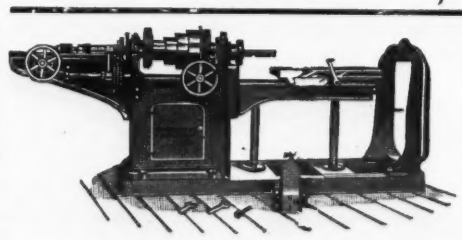

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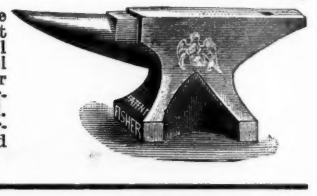

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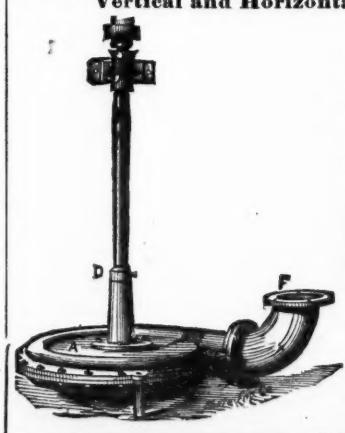

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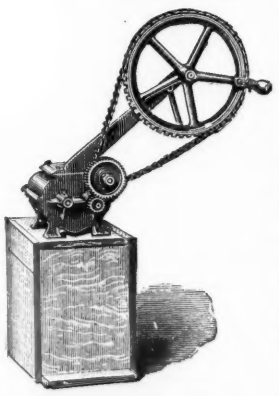

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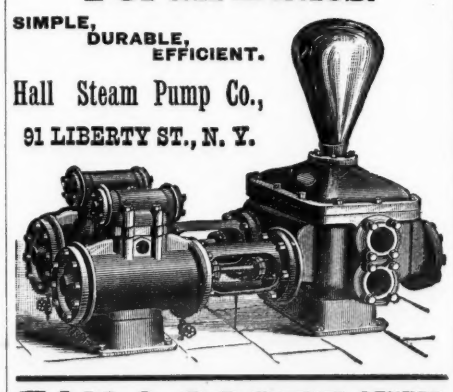

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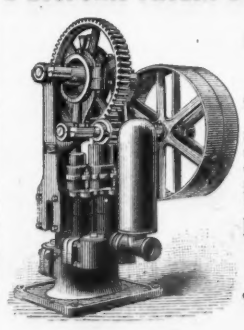

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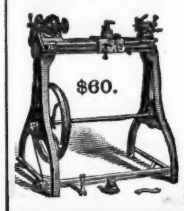

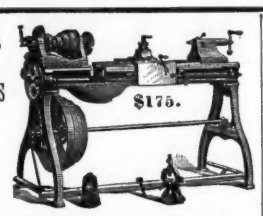

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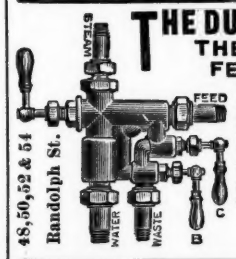

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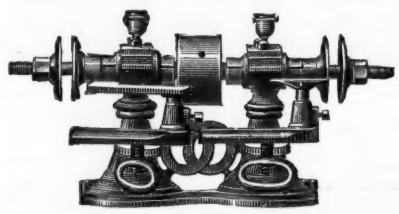

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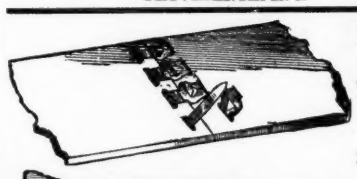

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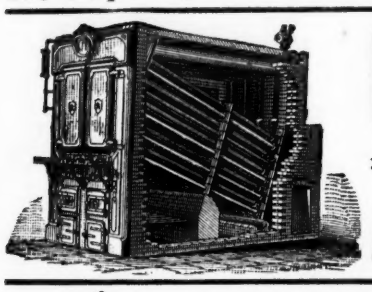

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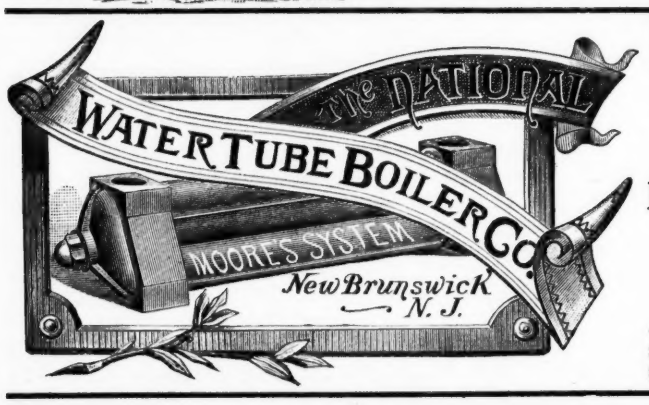

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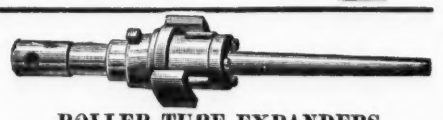

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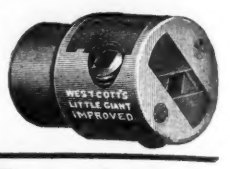

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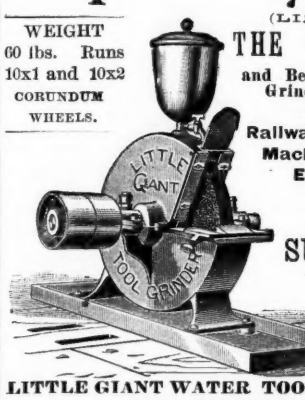

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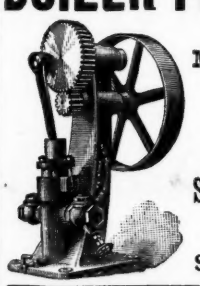

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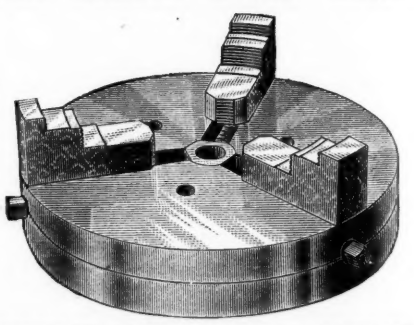

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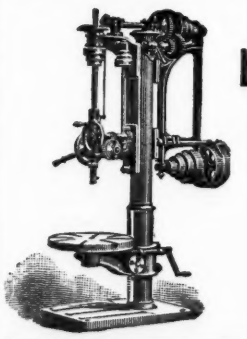

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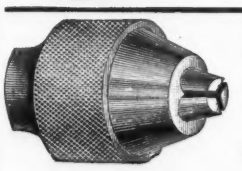

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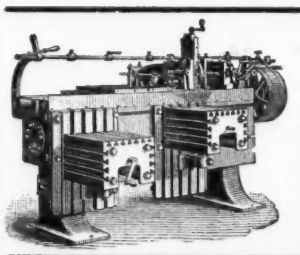

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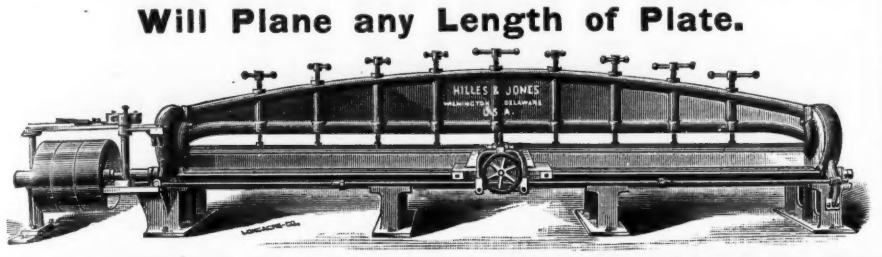

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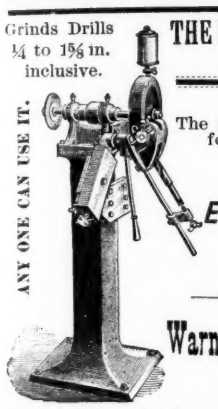

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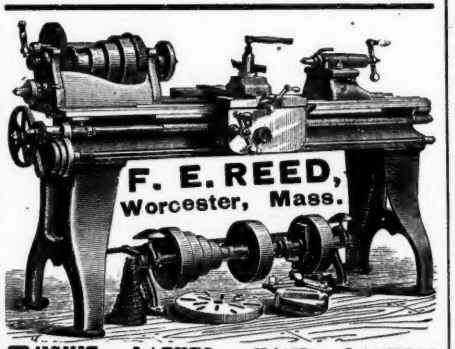

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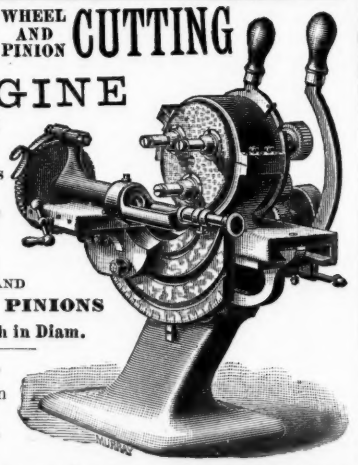

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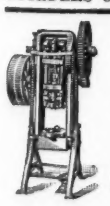

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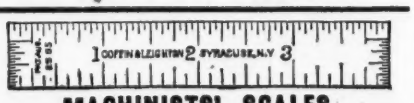

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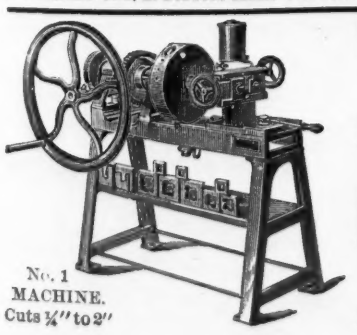

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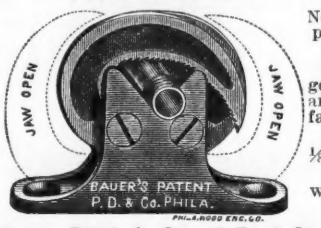

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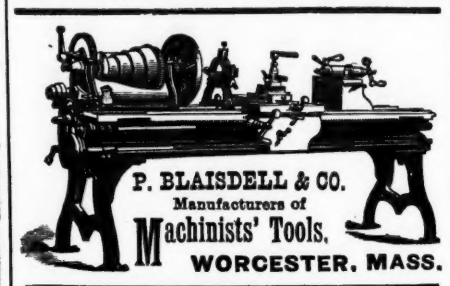

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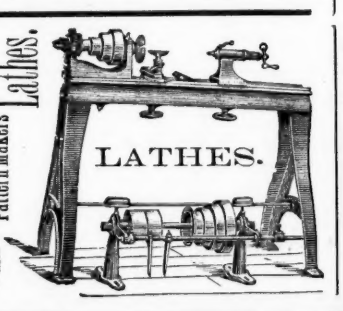

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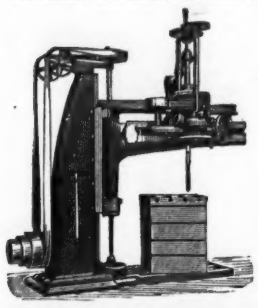

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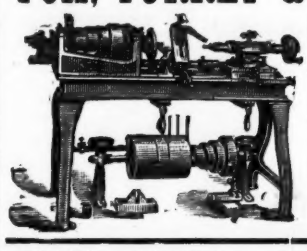

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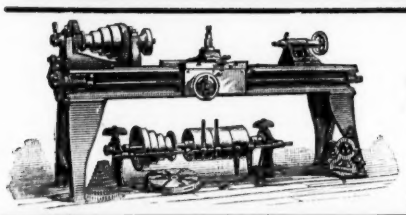

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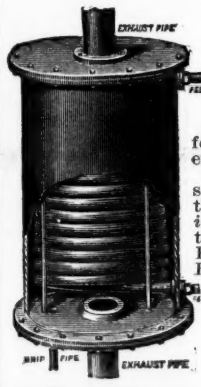

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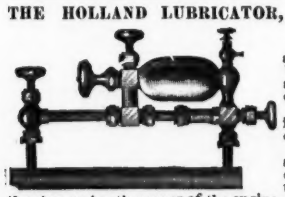

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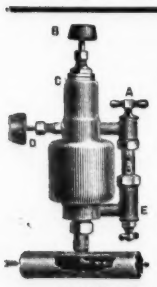

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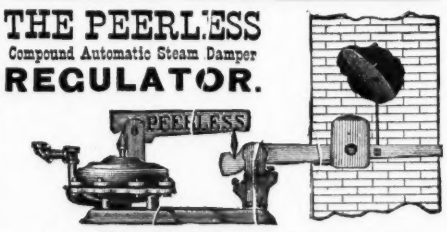

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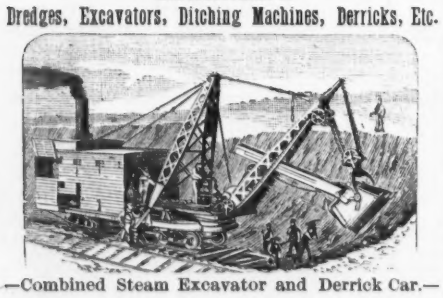

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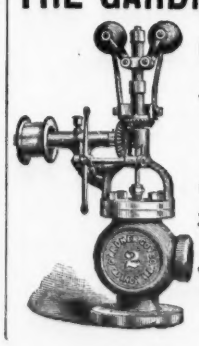

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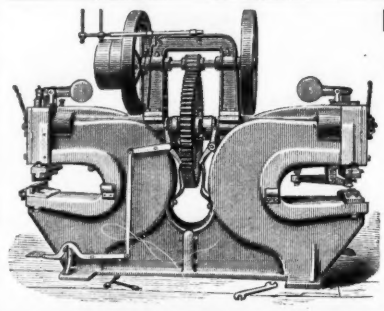

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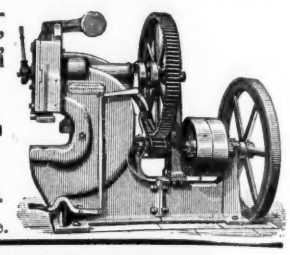

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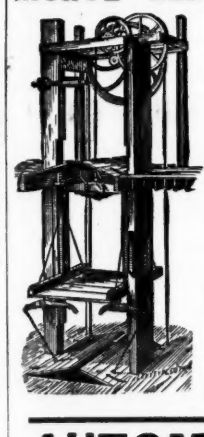

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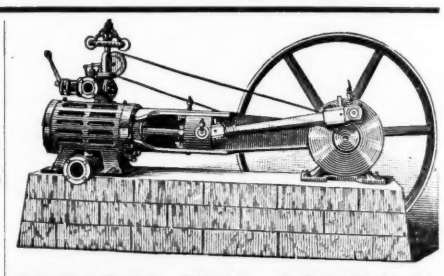

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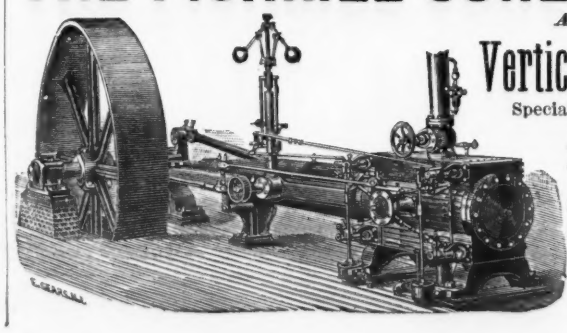

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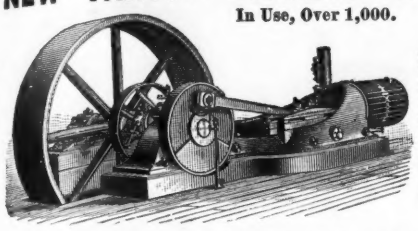

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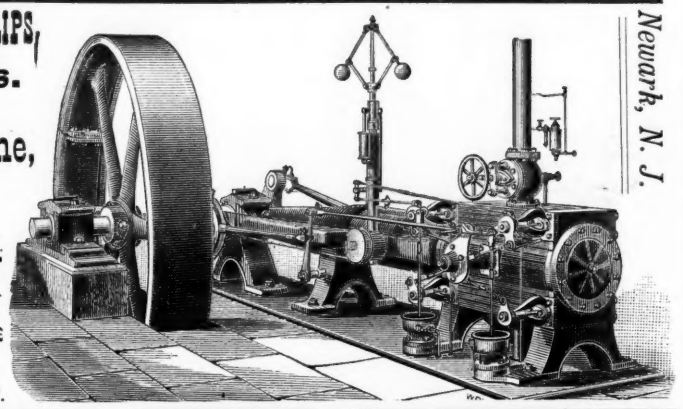

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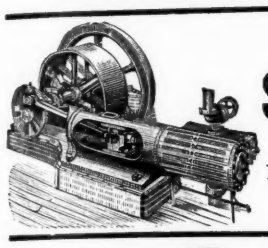

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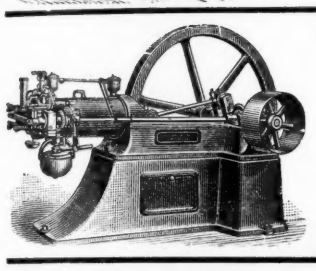

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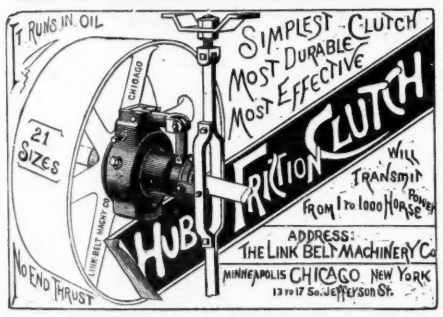

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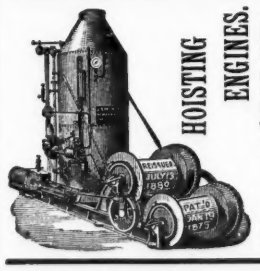

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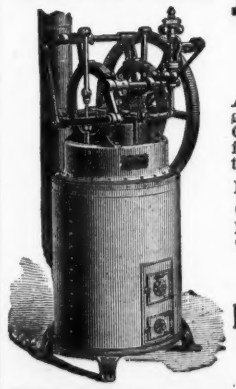

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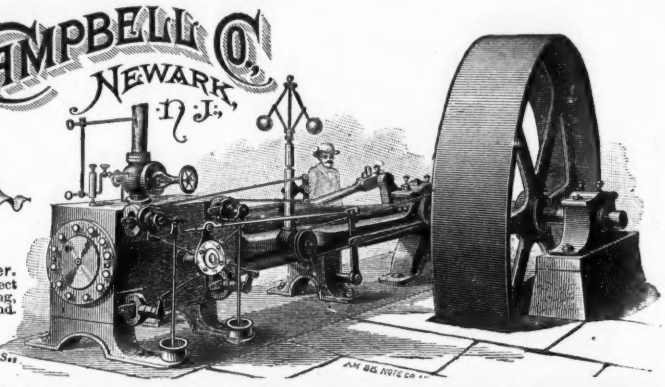

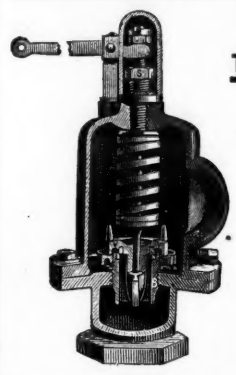

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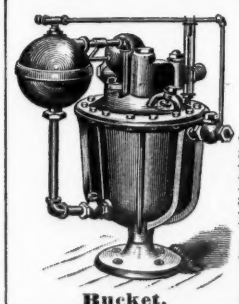

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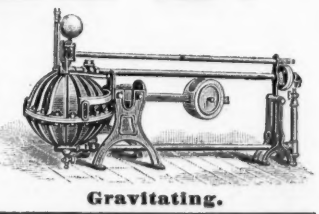

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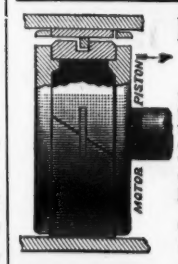

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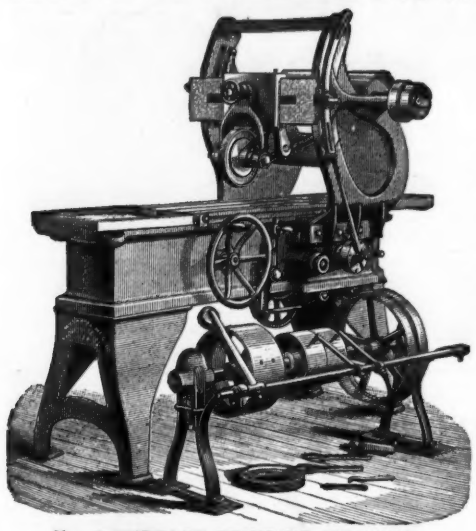

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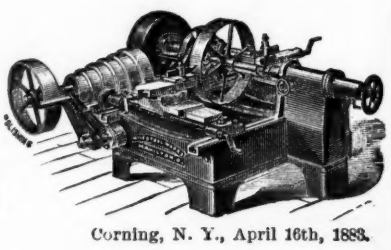

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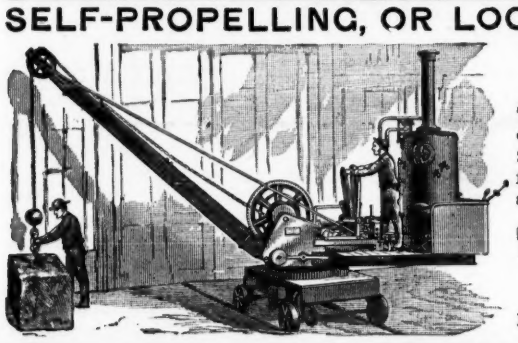

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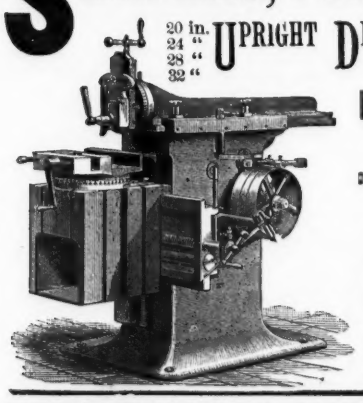

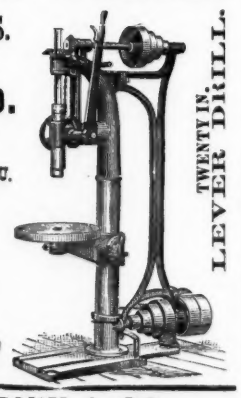

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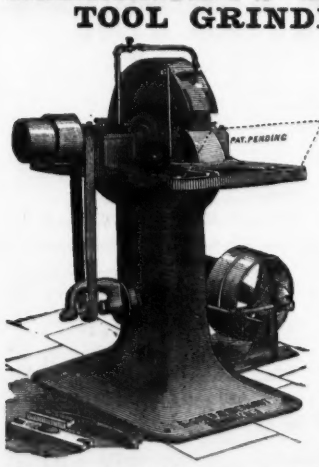

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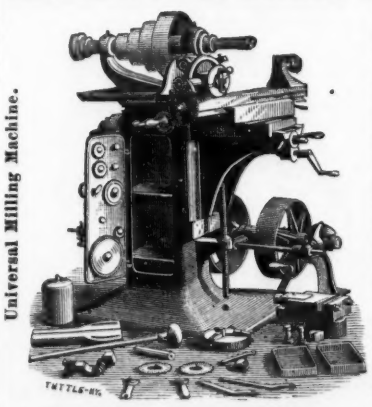

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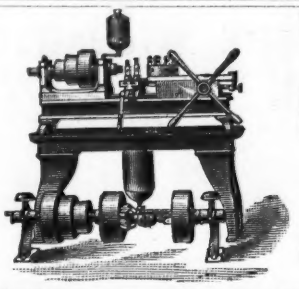

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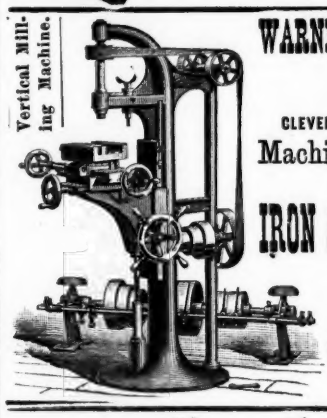

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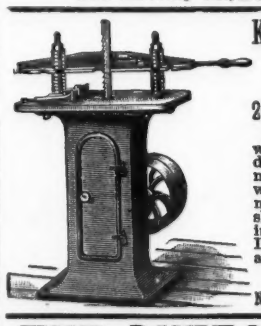

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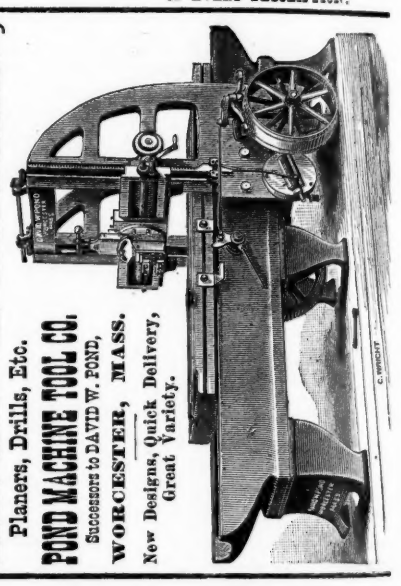

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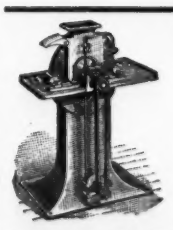

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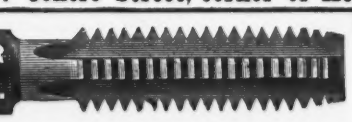

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